JULY 11, 1960

American Machinist / Metalworking Manufacturing

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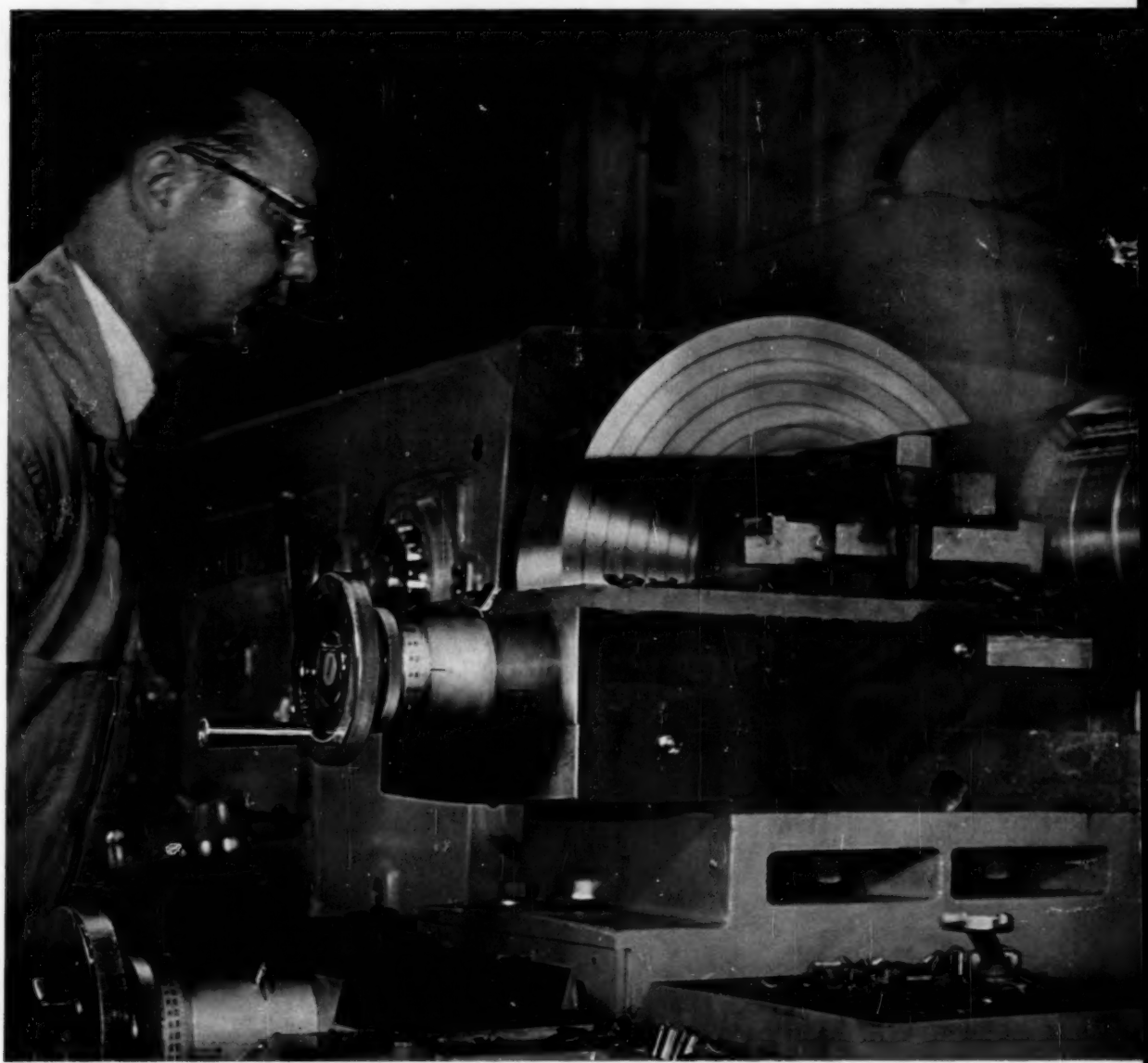


75-hp lathe removes SAE 6145 alloy steel at 200 cu in. per minute—see page 149

HOT MACHINING

Special Report, page 117

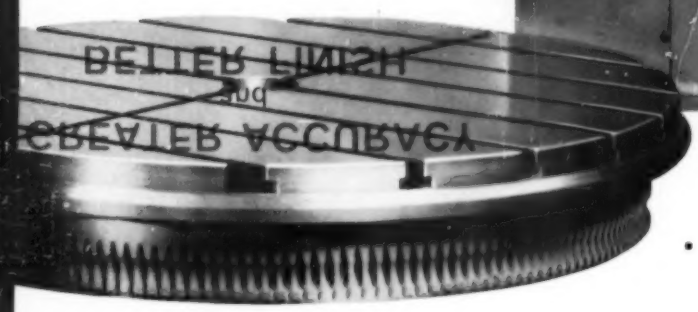
30" HEALD ROTARY

surface grinds

rotary index tables

with

GREATER ACCURACY
and
BETTER FINISH



. . . and up to five times faster, too!

On this Heald Model 361 30" Plain Rotary Surface Grinder, rotary indexing tables for other high-precision machine tools are ground flat and parallel within .0002", and to a surface finish of 15 micro-inches or better. Cast iron tables from 10 to 30 inches in diameter are easily handled, as well as a variety of miscellaneous parts.

Although high production was not a requirement, this Rotary enabled parts to be finished up to *five times faster* while obtaining greater accuracy and better finish than could be obtained with previous methods.

An adjustable wheel dresser built into the wheel-guard permits truing the wheel without resetting the wheelslide or moving the table. And a demagnetizing switch facilitates setup and unloading.

Heald offers a complete line of high-precision rotary surface grinding machines with chuck sizes from 6 to 30 inches and either manual or automatic reciprocation. Ask your Heald engineer for complete details, or send for a copy of Bulletin 2-361-1 Issue 2.

It PAYS to come to Heald

MMT-PE

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.
Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • Lansing • Milwaukee • New York • Philadelphia • Syracuse

HEALD

CIRCLE 151 READER SERVICE CARD

COVER:
75-hp Sidney lathe cuts 6145 steel, Rh 26C, at 288 sfm, 0.0835 ipr, and 1 in. depth of cut. See page 149.

American Machinist / *Metalworking Manufacturing*

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Hot Machining . . . The theory behind hot machining is to reduce shear strength of the work material to reduce chatter, power required, and wear on tools. Here's a detailed summary of an exhaustive study sponsored by the Air Materiel Command. *By William Pentland, Clarence Mehl, and Jens Wennberg, Cincinnati Milling Machine Co* 117

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METALWORKING REPORT

Significant current developments in tooling and production processes

CUTTING

Tool-Changing Drums

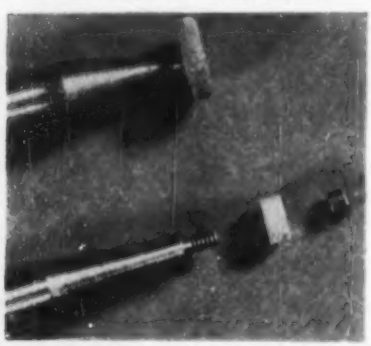
More drum-type machine tools will be introduced at the Machine Tool Exposition—1960 in September. The original drum machine, Wiedemann's turret punch, was one of the first to which numerical control was applied, and which demonstrated the advantages of tool changing combined with tape control.

The Burgmaster turret drill, also available with NC, will have competition from several other numerically controlled turret drills to be shown at the amphitheatre—testimony to the success of this kind of machine.

Kearney & Trecker will show improved versions of the Milwaukee-Matic, the pioneering design with automatic tool removal from a storage drum to a rotating spindle. In addition, there will be at least two others of this type; one with a 20-position automatic tool changer, the other with a 60-position changer. For more details, see p 103.

Wheels Replace Points

Mounted grinding points—for finishing operations on miniature bearings and other tiny parts—can now be replaced by grinding wheels in two diameters; 0.172 and 0.085 in. The cost advantage is 50¢ vs $2.00; but an important production advantage is that the wheels can simply be replaced, after wear, on the steel shank and clamped with a nut. This leaves the setup as it was, which was impossible when the grinding points, including integral shanks, had to be replaced (see photo).



Wheel replaces mounted point (top)

Bay State Abrasive Products, Westboro, Mass, makes the wheels, which are 0.036 in. wide and have a 0.034-in. center hole that slips over the chucked shank. According to Elden L Auker, vice president of Bay State, new manufacturing techniques and special grit combinations had to be developed to produce wheels in these minute sizes so they can operate at speeds to 40,000 rpm.

FORMING

Stamping in Hydraulic Press

Progressive dies operate in a high-speed hydraulic press that you'll see at the Chicago Machine Tool Exposition. The demonstration job will be blanking a 1⅜-in.-dia rotor and stator in 0.005-in. silicon steel.

The 25-ton press will operate at speeds up to 600 strokes/minute, with speed changed while press is operating. Feed is automatically adjusted to ram stroke. Pressure, which can be accurately adjusted with a hydraulic press, is set by dial. The unit is fitted out to stop without damage to the dies if "double blanking" crops up.

Setup is simplified by harmonic cam drives with which work stroke can be adjusted in steps from ¼ to 3 in. Punch breakthrough is adjustable without positive stops, so the press runs with less noise. Builder is Denison Engineering Div, American Brake Shoe Co, see p 150.

Big, Intricate Castings

Investment castings with intricate shapes, weighing up to 100 lb, can be produced from virtually any castable metal alloy by a process that involves both wax and ceramic. Arwood Corp, Groton, Conn, has been concentrating on special large shapes for aircraft, missiles, and radar; aiming for reliability, light weight, and minimum machining.

Metal pattern made in toolroom includes shrink allowances. Low-melting-point alloy is cast against pattern (or magnesium is machined to match) in two or more parts, depending on parting line and coring. Blended wax is pumped into mold at 100 psi and at 140 F, cooled, then stripped from mold and invested by dipping and drying in ceramic slurry until coating is ¼ in. thick.

Wax is melted out at 400 F, then ceramic shell is baked at 1600 F for 40 minutes. Metal is poured from induction furnace, though electric-arc furnaces are being installed for more pouring capacity. Water-soluble-wax cores are inserted before blended wax is injected; then core is washed out before ceramic shell is built up. Gates and risers are standard design made from a wax-extrusion press.

One special production technique is the method of blending wax and pumping it at 150 psi from wax room to wax-injection presses of special design, which fill molds quickly and accurately.

Form Cones Easier

The easy way turned out to be the best way at Lockheed's Sunnyvale Missile and Space division, where conical sections for missile nose cones are now being rolled at a saving of $50,000/year. Although the parts required are shells that represent truncated cones, they are being rolled as if they were complete cones, with the apexes anchored on the rolling line of a Farnham press.

The full cone extension to the apex is represented by a frame and anchoring pin, filled in between the frame legs with sheet metal that

dummies as the pie-shaped blank. The actual workpiece is attached to the skirt of the dummy sheet, where it rolls up in a neat truncated-cone contour in minutes. The job used to take 8 hr, which included considerable adjusting and rerolling.

HEAT TREATING

High-Temp Gas Carburizing

Watch out for carbide precipitation if you try gas carburizing at 1850 to 2000 F instead of the usual 1700 F, says a recent report by Surface Combustion Corp. High-temperature carburizing saves time and increases the rate of carbon penetration, or diffusion, into steel; but it also increases the amount of carbon that can be taken into solid solution at the higher temperature, which may cause carbon precipitation in and around the grains.

Another possible problem is a reduction in net/gross furnace load because at higher temperature the fixtures and furnace trays will have less strength, and therefore the fixtures must be heavier and the trays must be loaded lighter than usual.

From a production standpoint, something around 1850 F is the optimum temperature. To show worthwhile advantages over carburizing at the lower conventional temperatures, the work should require a minimum case depth of 0.075 in.

INSPECTION

Creepy Tooling?

Plaster master tooling at Boeing Airplane Co is tested in seven months for creep in a $3000 machine that simulates conditions in storage over a six-year period. Some 15 specimens can be checked at one time under controlled humidity, temperature, and pressure.

Specimens are placed in a 6-ft enclosed tank over water, and are loaded (to simulate weight on the tooling when it is stored) by rods that support 1- and 5-lb weights. Water temperature is controlled up to 200 F, within 2 degrees. Humidity is indicated by a recording gage. Deflection under load is detected by a dial indicator that can be moved along the top of the loading rods on a machined steel channel.

From test results, Boeing has found that current tooling designs are adequate to prevent creep within tolerance at normal temperatures and pressures. The company's manufacturing research department recommends that all tools be coated with a gel face ¼ in. thick, and that all reinforcing should be closed-box, plastic-faced aluminum honeycomb.

THE OUTLOOK

Metalworking firms are looking beyond the expected summer lull to a general increase in business in the fourth quarter. Steel production should start to rise in August, and automakers will be getting into full swing on their 1961 model runs. Business now is steady; the chief exception being the major appliance industry, where sales are slow and inventories heavy. For details see page 97.

WELDING

Spotwelding Large Cabinets

If you can't raise the spotwelder to reach the top of a large assembly, lower the floor in front of the machine so you can put the work at the right height. That's the trick Westinghouse is employing daily in its Electronics Division at Baltimore.

A section of the floor right in front of the welding machine is mounted on a hydraulic lift and can be adjusted to exactly the desired position. See p107 for more details on this equipment and other ideas for improved job-shop efficiency.

ASSEMBLY

Mini-Car Body Drop

Austin (of England) drops unit bodies for the small 850 (also the Mini-Minor) onto the front and rear axle units at final assembly much like conventional bodies are added to chassis units elsewhere. The fact is that there isn't much underbody to drop to; only a rear-axle unit with springs, shock absorbers, brakes, and muffler; and the front end with wheel suspension, the crosswise engine, and a stub frame. Fixtures on the assembly conveyor space the underbody units as the body comes down.

This may foretell production technique for new US mini-cars (smallest Ford, for example), which will be unit (welded) bodies and small engine-transmission units.

FINISHING

Slurry Deburring

Fast mechanized polishing and deburring is the function of a new family of machines that have some of the aspects of machine tools; general design resembles a multi-spindle automatic lathe turned on end, and parts are held individually on rotating spindles as they are plunged into a high-speed stream of abrasive slurry. Production rate can be as high as 1000 parts/hr; finishes range from feather-edge removal to producing 0.015-in. radii on hardened gear teeth; and smoothness is at least as fine as 10 micro-in.

The Roto-Matic machines, presently available only in United Kingdom from Rotofinish, Ltd, are designed in 1-, 2-, 4-, 8-, and 16-spindle models. On the multi-spindle machines, the spindles hold the work and rotate it at 12 rpm while the spindles circle a central shaft in cycles from 1 to 7 seconds. Air cylinders move the spindles down to immerse the parts in a tubfull of abrasive compound—with the tub rotating at 16 or 32 rpm. As the spindles complete the circuit, they retract so the parts can be dried by air blast, then release the parts.

One- and two-spindle machines do not rotate their spindles around the tub, but the tub speed is higher—250 rpm. Surface speed of the abrasive against the work is up to 2500 fpm. Polishing effect is varied by adjusting relative work speed in the slurry, which is a water-soluble compound with rust inhibitor.

Self-Tuning Ultrasonic Units

Ultrasonic cleaners that readjust automatically as the tank solvent

COMING IN AM/MM

Standard Data for Feeds and Speeds—Special Report
1 + 1 = 10? A simple explanation of binary numbers—the heart of all numerical control systems

level changes, parts are added or removed, temperature changes, or materials change have been announced by Powertron Ultrasonics Corp, Garden City, NY. The units are rated at from 1000 to 3000 watts. A feedback transducer continually corrects output phase and frequency to maintain the standing-wave, or optimum, condition.

The cleaner can easily be incorporated in an automatic production line because it is self-tuning, and needs no operator. It is available in standard sizes from ¾ to 75 gallons, and also comes in modular sizes.

Bright Platinum Plating

Heavy, crack-free, bright platinum deposits can be made directly on copper, brass, silver, nickel, aluminum, and titanium from DNS solution produced by Johnson, Mathey & Co Ltd, England. Based on sulfatodinitrito-platinous acid, the solution contains 10 gm of platinum 100 cc, but diluted to 5 gm/liter for general use. It is acidic, and must be used in glass, plastic, or earthenware tanks. For use on tin, zinc, cadmium, or steel, an undercoat of silver or nickel must be employed.

Deposits are claimed to be exceptionally bright at all thicknesses, and no polishing is required.

MATERIALS HANDLING

It's Almost Human!

An obedient parts manipulator, called Unimate, will perform human-hand and arm functions up to a maximum of 150 different sequential commands. Once instructed by an operator, who puts the manipulator through all required motions, it will load, unload, feed work, assemble, and even operate a machine automatically.

A jointed arm has a variety of hands that are attachable for different tasks—and the machine will even change hands during a sequence, if so instructed, to be able to grasp different work or the same work differently. It will work with five "degrees" of freedom, and can sweep a volume of 350 cu ft in an operating arc of 270°.

Developed by Consolidated Controls Corp, Bethel, Conn, the device is said to be dramatically anthropomorphic (human-like) in its abilities. Instruction is given by a setup man who moves the hand through each of the tasks to be performed. His motions are recorded on a magnetic memory drum, and until they are erased, the manipulator duplicates these motions.

Erector-Set Conveyors

Three basic members—plus accessories—make a conveyor system by Dexion, Ltd (England), truly universal. Like an Erector or Meccano set, it can be quickly demounted and set up again for different function, using the same glidewheels (to carry parts trays or parts themselves), slotted angles (for bracing and support from the floor), and straps (for side pieces, curves, and braces). The wheels have ball bearings. Existing applications include transfer conveyors, assembly conveyors, and storage racks.

MATERIALS & COMPONENTS

Bright Zinc on Chain

Bright-as-a-new-dollar-from-the-mint zinc plating is being applied to chain and chain products in a new plating room at American Chain & Cable's York plant. Advantage, aside from better original appearance, is higher corrosion resistance in storage and during handling at no added cost. The extra-bright finish is chemically bonded and plated to welded, weldless, and iron chain, which is thoroughly cleaned before treatment. Plating installation was made after a pilot-plant tryout.

Hard-Water Phosphate

An iron-phosphate coating for metal products can accept up to 15 times more alkali (from hard local water) than usual, and still hold its proper pH rating without any special pH control. Detrex 910 is a chemical cleaning and phosphating compound, applied in continuous spray-washing equipment of 2 to 6 stages. Field tests have proved its suitability to auto stampings, metal furniture, gardening implements, and tools and hardware. Purpose is identical with other phosphates—to bond paint to metal surface for wear and corrosion resistance.

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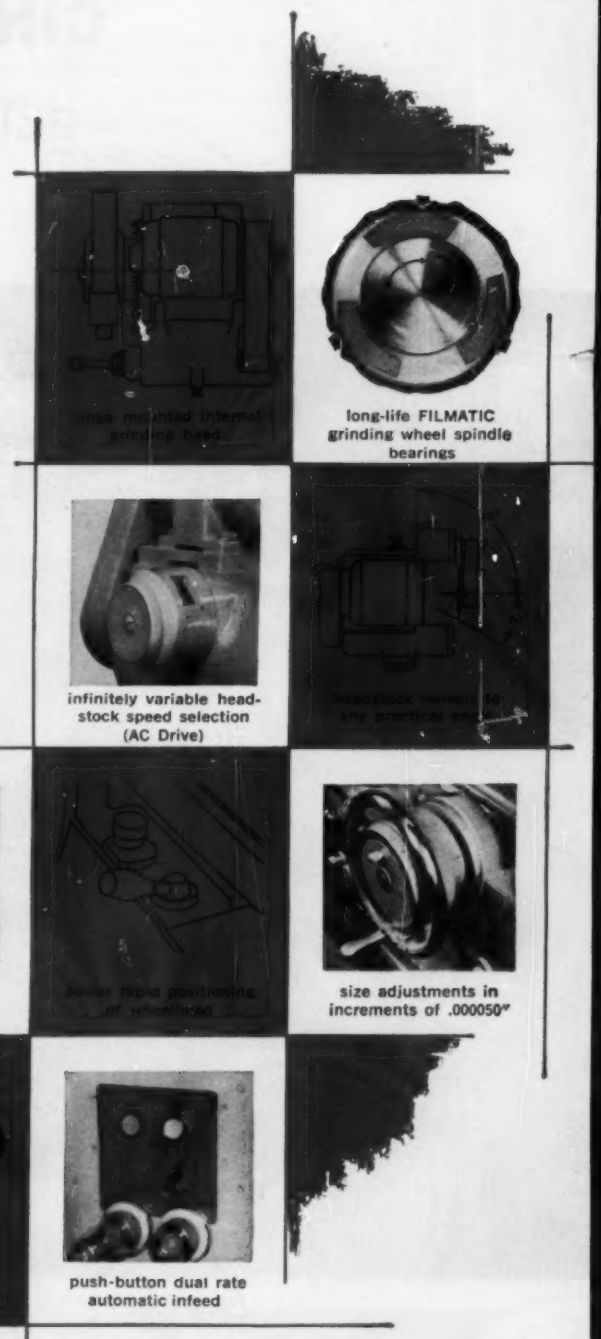
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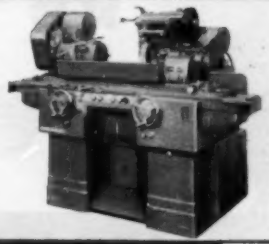

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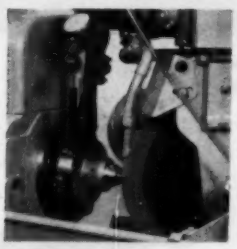
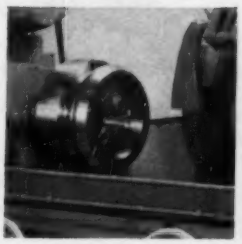


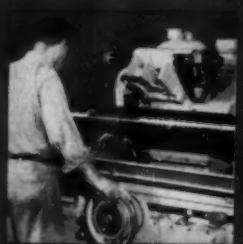
production grinding with
Acrasize gaging

infeed grinding a hub

grinding a shoulder,
wheel and drive interchanged



grinding a bevel



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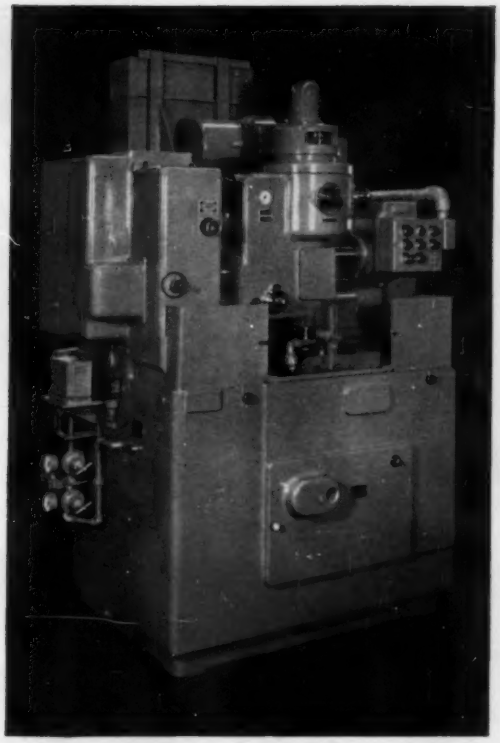

Fellows
4GS Gear Shaper

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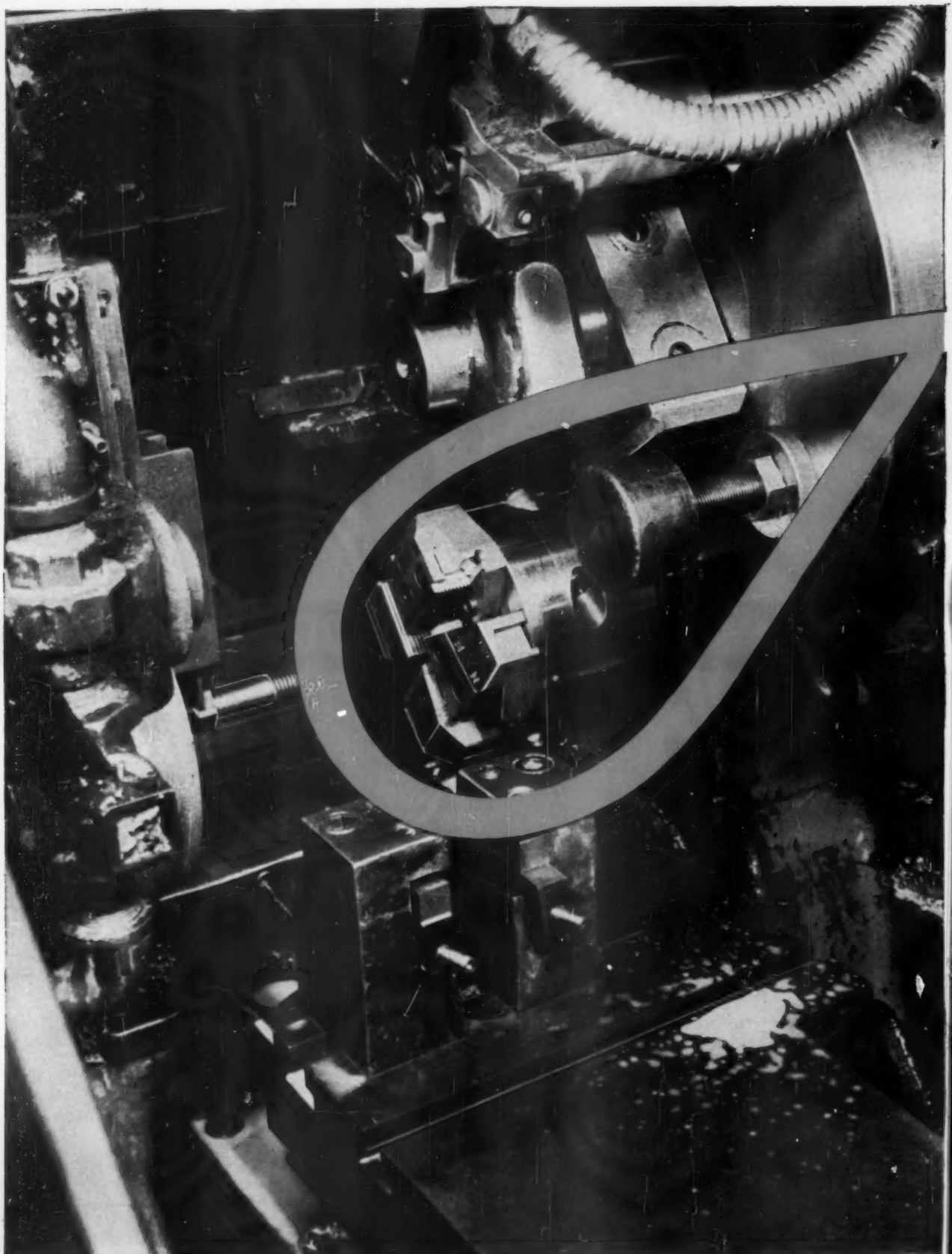


AUTOMATIC THREADING

to close tolerances on single-spindle automatic

Automatic opening and closing and *ability to meet exacting concentricity requirements* were the principal reasons a LANDIS Die Head was selected to thread drive wheel cap screws for industrial lift trucks manufactured at the Yale Materials Handling Division of The Yale and Towne Mfg. Co. in Philadelphia, Pa.

⅝", 11-pitch UNC threads are cut ⅞" long on 3140 steel by a LANDMATIC Head on a Cleveland Single-Spindle Screw Machine. Threads must meet Class 3 tolerances—in addition, the threads must be concentric with the screw body within .002".

A 1-¼" FD LANDMATIC Head is being used for this work—a stationary, self-opening head arranged for automatic closing. A special over-travel feature eliminates the necessity of a complicated, accurately-set closing cam on the machine. Threads are produced to necessary tolerances at 18 SFM, with 400 pieces completed between chaser grinds.

This head, other than the over-travel feature, is a standard LANDMATIC Heat-Treated Head (primarily used for turret lathe threading) equipped with standard LANDIS Tangential Chasers. Even with this tough material, close tolerances are met with an excellent number of pieces between grinds. Further economies are realized as the chasers with regrinding will produce these threads for 80% of their original length. Wide range and oversize capacity are important features of the head—¼" to 1-¼" normal range, short thread lengths up to 2-¾" in diameter with oversize chaser holders.

A wide variety of sizes and types of LANDIS Heads allow you to gain the utmost "threading efficiency". Send us your specifications and ask for Bulletins F–80 and F–90—let us suggest the LANDIS Head most suitable for your needs.

LANDIS *Machine* COMPANY
WAYNESBORO • PENNSYLVANIA • U. S. A.

MMT-PE
BOOTH NO. 432

at the MTE...
see the outstanding features of the

all NEW

be sure to see
LANDIS
the years ahead line of
precision grinders . . .

▲ New Landis 6" semi-automatic type R plain cylindrical grinder

◀ New Landis type R universal cylindrical grinder

MMTPE

LANDIS
PRECISION GRINDERS

. . . now Landis offers the only new complete line of Plain and Universal Grinders with all these features. All new designs engineered for precision and production . . . not features hung on or added to an obsolete design.

allNEW wheel feed:
at eye level with turning handwheel during grinding feed for easier setup and operation

allNEW plain grinder truform dresser:
with both slides on preloaded balls for exact profiling

allNEW beds:
no hydraulic oil or open drains in bed—maintains better machine alignment

allNEW plain grinder footstock:
preloaded ball spindle for no shake and maximum stability

allNEW universal internal fixture:
compact, swing type—easy to position

allNEW universal feed:
for semi-automatic operation

and MICROFEED
a major breakthru in size control—available on these machines

LANDIS

world leader in precision grinders

Landis Tool Company, Waynesboro, Pennsylvania

YOUR BEST GUIDE TO

1960's RECORD BREAKING EXHIBITS OF METALWORKING'S EQUIPMENT AND SUPPLIES

WILL BE FOUND IN THE

Chicago Exposition Issue

of American Machinist / Metalworking Manufacturing

a 200-page advance look at the Machine Tool Exposition, Production Engineering Show and Coliseum Machinery Show

authoritative descriptions of "WHAT'S NEW" in equipment, materials and supplies at each of the three expositions

a preview to help you plan your Chicago visit to make the most valuable use of your time

an authoritative reference for the things you examined and discussed during your visit

a comprehensive trip through the three exhibit halls if you are unable to attend

To get the full picture of the Chicago exposition (all three shows) LOOK FOR THE

August 22, 1960 Issue of

American Machinist / Metalworking Manufacturing

THE BIGGEST (and most authoritative) ISSUE ON METALWORKING'S BIGGEST SHOW

How Greenlee Bros., Rockford, Ill., Saved $19,600 in 12 Months with An AO Protection Program

GREENLEE BROTHERS, ROCKFORD, ILLINOIS installed a complete compulsory eye protection program in 1959. The investment quickly paid off in dollars and cents as well as bettered morale, pain-prevented, sight savings, skills protected. And remember, most of the first year's cost of $14,237 is non-recurrent.

VITAL STATISTICS

- 64% reduction in workers making trip to nurse.
- 51% reduction in workers making trip to doctor.
- 90% reduction in lost time hours due to serious eye accidents.
- 3 Eyes Saved*
  *Actually 11 eyes, but 8 of the accidents occurred in the foundries. These were previously covered.
- $19,600 estimated savings.

What plant investment pays off as rapidly? Send for new brochure, "Eyes Are Expensive Targets".

American Optical
COMPANY
SAFETY PRODUCTS DIVISION
Southbridge, Massachusetts

Safety Service Centers in Principal Cities

Always insist on Trademarked Safety Products

Your Surest Protection . . . AO SURE-GUARD Products

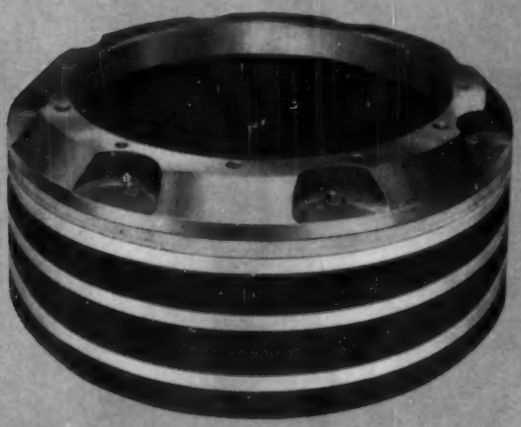
REDUCE DOWN TIME

with Gardner 'grindaway' tape bound cylinder wheels

continuous, uninterrupted production

eliminates operator hazard

higher strength with tapes an integral part of wheel



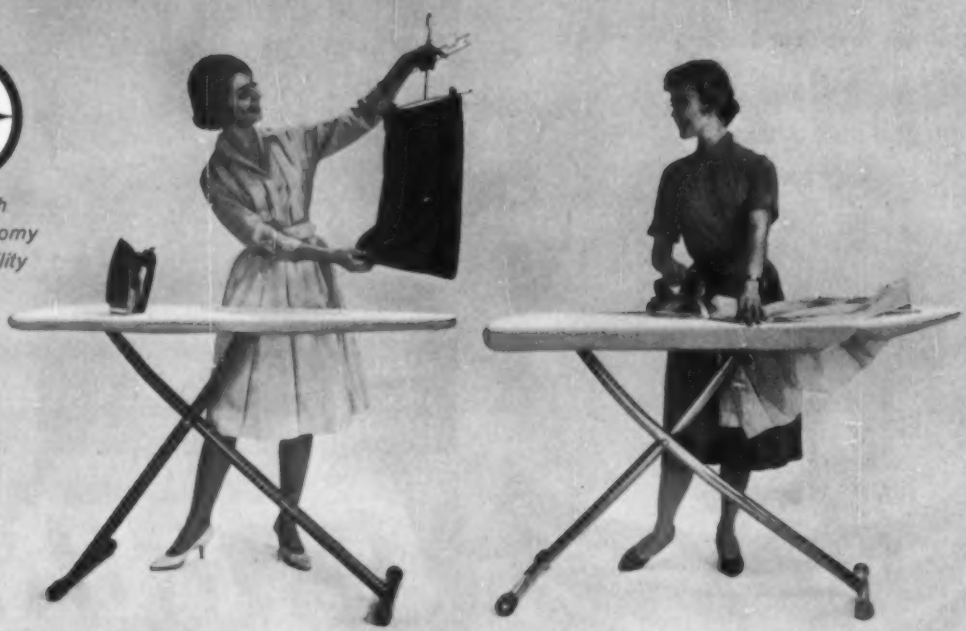
Glass fibre tapes grind away as wheel wears . . . eliminate production stoppages required for removal of wire binding.

GARDNER

abrasive discs

BELOIT, WISCONSIN

Now 6 out of 7



Steel

For strength
. . . economy
. . . versatility

ironing "boards" are made of sheet steel

Just fifteen years ago, all but 15 per cent of ironing boards were made of wood. Today, it's the other way around: 6 out of 7 are made of strong, durable, inexpensive sheet steel, with features that could never be achieved with wood.

The "Mary Proctor Hi-Low Ironing Table" shown here is a good example. Its steel top is pleated for extra strength, with steam vents that channel heat away from the ironer's lap for cooler ironing. Sturdy tubular legs rolled from sheet steel are light in weight yet provide solid support.

Bethlehem furnishes large tonnages of cold-rolled steel to the Proctor-Silex Corporation, makers of the "Mary Proctor Hi-Low Ironing Table."

If you work with steel sheets—hot-rolled, cold-rolled, or galvanized—you can always count on Bethlehem sheets for completely dependable performance. Our engineers will be glad to discuss your sheet-steelworking problems with you.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

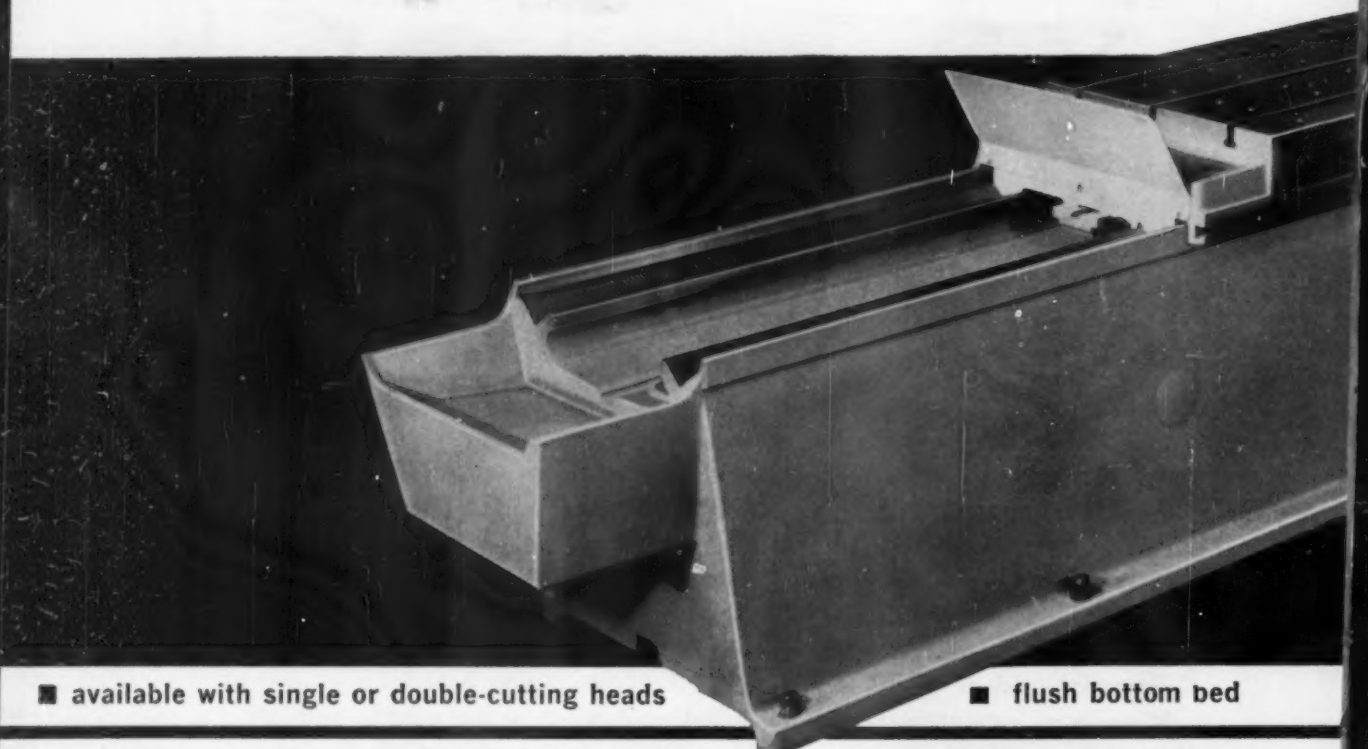
BETHLEHEM STEEL

imagine

buying a **GRAY** planer for only

$30,660

above basic price includes 30" x 6' planer, one rail head, electric drive and controls



- available with single or double-cutting heads
- flush bottom bed
- new Gray knee
- synchro-mesh table replacer
- full pendant control of table
- Gray Safety nut
- full floating drive shaft
- quick acting saddle and slide clamps
- abutment tool aprons
- non-shock pneumatic tool lifters
- infinite feed range

technical bulletin available

◄ CIRCLE 168 READER SERVICE CARD

CIRCLE 169 READER SERVICE CARD

the new 30"-36"-42" flying scot

■ square locked throughout ■ knee and rail counterbalance ■ pyramid side walls on bed

■ vee ways ■ gray non-metallic ways—optional ■ maximum capacity—table width

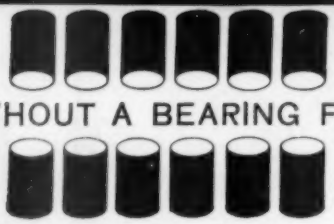
■ 'reservoil' lubrication ■ high table speeds ■ duplex tables optional ■ new column

■ helicone transmission ■ space saver drive ■ table safety stop ■ forced lubrication

horizontal milling and boring machines
planers
planer type milling machines

THE G. A. GRAY CO.
CINCINNATI, OHIO

CIRCLE 170 READER SERVICE CARD



MORE THAN 5,000,000 TONS OF STEEL WITHOUT A BEARING FAILURE

The Torrington Company, Bantam Bearings Division, South Bend, Indiana, is especially noted for the high quality of its rolling mill bearings. Usage of modified AISI 3310 USS CARILLOY Steel in races enables Torrington to manufacture quality bearings with a foot-pound energy absorption rate of a magnitude impossible to obtain with any other conventional alloy steel. Translated into performance, rolling mills equipped with these bearings have produced more than 5,000,000 tons of steel without a bearing failure!

Before using the modified USS Alloy grade, Torrington tried several different types of steel which gave considerably lower tonnages before failure occurred. Then with the application of the 4% nickel alloy (Modified 3310) they first succeeded in obtaining progressively higher tonnages to the 5,000,000-plus tons of rolled steel production enjoyed today.

In addition, the Torrington Company uses the 52100 series of USS CARILLOY Steels. The types of 52100 steels used in through-hardening anti-friction bearings consist of grades similar to AISI 50100, 51100, and 52100. These steels have certain special characteristics such as wear resistance and compressive properties essential in bearings, which are obtained by adding varying amounts of chromium to high carbon steels.

The chromium, manganese, silicon are varied according to the cross section involved in the finished part and its expected response to heat treatment, or the microstructure needed to impart wear and other special properties. USS CARILLOY Steels in this class have long been noted for their superior quality, cleanliness and wear resistance.

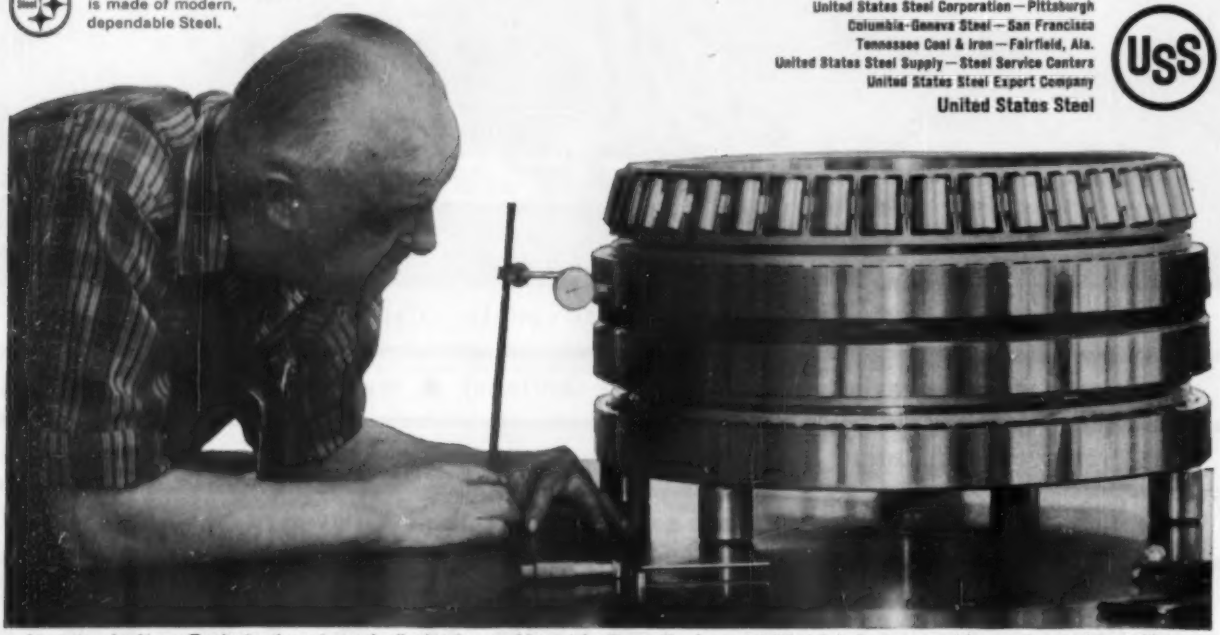
Special alloy steels such as those used by Torrington can be developed for other special needs. In addition, all standard alloy steel grades in a complete range of USS bar and semi-finished sizes are available. For more information, write United States Steel, Room 2801, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS and CARILLOY are registered trademarks

This mark tells you a product is made of modern, dependable Steel.

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Ala.
United States Steel Supply—Steel Service Centers
United States Steel Export Company
United States Steel

USS



Inspector checking a Torrington 4-row tapered roller bearing used in metal rolling mills. A special 4% nickel alloy was used for greater wearing qualities.

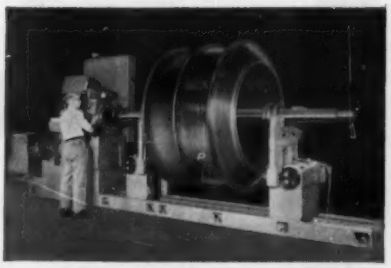
Would you take a parrot's word for it?

Why take anybody's word for it?

Static and dynamic balancing of rotating parts is a critical quality control process. The elimination of destructive vibration is "life insurance" for your product. It is worth doing *correctly*.

Test before you buy! When you buy a balancing machine, you'll want to outline your requirements specifically—and insist on comparative tests. Only then can you *know* what you're buying. No reliable supplier of balancing machines will refuse to cooperate in these tests!

Gisholt shows you. Gisholt invites you to see your work balanced on a Gisholt Balancer and to observe a series of scientific balancing tests—to prove that your tolerances and production requirements will be met, *before* you buy!



Gisholt 6U Balancer handles variety of rotors from 350 to 10,000 lbs. This 5600 lb., double-inlet wheel and shaft assembly is rotated at 150 r.p.m. and balanced within .0003" bearing displacement. Despite heavy workpieces and massive machine, no special foundation is required for accurate operation.

FREE BOOKLET—Because there are vast differences in balancing equipment, it is important to know how the basic methods of measuring unbalance compare (mechanical, optical and electrical). The Gisholt Balancing Catalog explains these methods in detail—so that you can easily draw your own conclusions.

Ask your Gisholt Representative for this booklet or write for your free copy.

MMT=PE

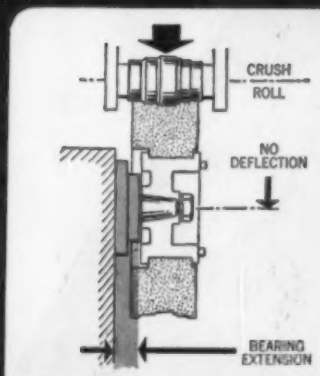
GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

Investigate Gisholt's Extended Payment and Leasing Plans

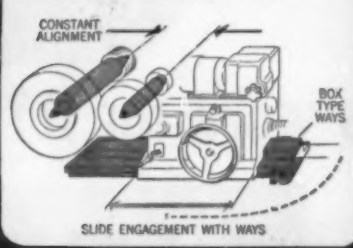
Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Machines
• *Factory-Rebuilt Machines with New-Machine Guarantee*

All industry is talking about the new Van Norman



Rugged, heavy Grinding Wheel Spindle with its additional bearing extension withstands the terrific pressures of crush roll forming with NO DEFLECTION.

Maintained alignment of Grinding and Regulating Wheel Spindles is assured by the high engagement ratio of the Regulating Wheel Slide length to width.



SYNTHANE PLASTIC TUBES FINISHED TO AUTOMATICALLY...

VN Diversimatic Centerless Grinder delivers greater precision, finer ... costs less to buy,

Synthane Corporation cut production costs of their small (under ½ inch O.D.) laminated plastic tubing when they switched to a VN Diversimatic Centerless Grinder. This low-priced, low-maintenance VN grinder is so exact that they can rely on machine accuracy to finish the tubing O.D.

Maintained Precision Assured—Secret of VN's exact grinding accuracy is its anti-friction grinding and regulating wheel spindles, which assure maintained precision in the workpiece under *any* conditions.

Faster Set-Ups . . . Increased Production . . . Greater Accuracy. The Van Norman Centerless Grinder is specifically engineered to produce more precision grinding work per operator per work shift . . . designed for in-feed

VAN NORMAN

SPRINGFIELD 7, MASSACHUSETTS

EXACT TOLERANCES ECONOMICALLY

tolerances in small diameters less to maintain

work, thru-feed work, crush form grinding and profile work. The Van Norman Centerless Grinder is rugged, and designed for heavy duty, long run production.

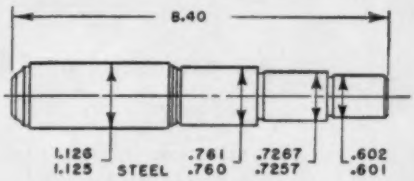
Send For Free Booklet—"Centerless Grinding," your local VN Franchised Distributor will be happy to discuss how VN Centerless Grinding may increase production and cut costs for you . . . call him NOW.

MACHINE COMPANY

A DIVISION OF VAN NORMAN INDUSTRIES, INCORPORATED

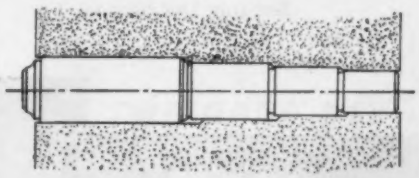
Another typical Van Norman centerless grinder cost-saving application

CUSTOMER'S PROBLEM:



A prominent automobile manufacturer wanted to grind all diameters on worm shafts. The problem was more difficult because the part did not have the same hardness throughout its entire length. Automatic cycling was required as well as post-operational gauging with feed back to machine for size compensation.

VAN NORMAN SOLUTION:



A Centerless Grinder with a Hydraulic Diamond Dresser was used to grind this part. Three operations were used because of the large amount of stock removal required, and also because of intermediate operations such as hardening and thread milling. These operations were:

1st Operation—Grind all diameters to +.012/.011 in soft state.
2nd Operation—Grind all diameters to +.002/.003 after hardening.
3rd Operation—Final grind all diameters to size.

THE RESULT:

Complete customer satisfaction. The machine functioned as planned. Production was as follows:

1st Operation—120 pieces per hour at 100%.
2nd Operation—180 pieces per hour at 100%.
3rd Operation—240 pieces per hour at 100%.

Two Van Norman machines are now in use on this job.

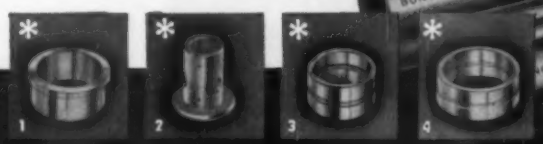
2574

BUNTING®
BEARING ALUMINUM BARS

have you learned what **Bunting Bearing Aluminum Bars** can do for you?

No other low priced bearing metal delivers all the many fine qualities embodied in Bunting Bearing Aluminum. Its physical properties add up to a remarkable and ideal material for most general bearing applications. Light weight is an added advantage. It machines easily and rapidly, saving labor cost. All bars are machined on all surfaces, reducing waste metal to the minimum. And it is carried in stock in 138 sizes of 13" tubular and solid bars by your local Bunting Distributor.

BUNTING AL 2028 ALCOA 3½ x 2½ BUNTING AL 2028 ALCOA 3½ x 2½
BUNTING AL 1822 ALCOA 2¾ x 2¼ BUNTING AL 1822 ALCOA 2¾ x 2¼
BUNTING AL 1320 ALCOA 2½ x 1¾ BUNTING AL 1320
BUNTING ALS 16 ALCOA 2
BUNTING AL 1216 ALCOA 2 x 1½ BUNTING AL 1216 ALCOA
BUNTING ALS 12 ALCOA 1½ BUNTING ALS 12



case in point*

Specimens of Bunting Aluminum Bearings replacing bearings of other metals which cost twice as much. No sacrifice of performance or life.

1. Cylinder gland bearing. An example of how to save money on large, thick-wall bearings. 2. A high speed 150,000 RPM . bearing for turbo super charger. Intricate machining, many dimensions, close tolerances. 3. Solid gear bearing to replace roller bearing. Bunting Bearing Aluminum is ideal where thick wall is essential. 4. This thick wall floating rod bearing affords an attractive economy in material cost, and an additional value in light weight

MACHINE SHOP SERVICE . . . Small lots of special design bearings, not obtainable from stock, can be procured immediately from fully equipped machine shops through all Bunting Branches. The wide range of sizes of Bunting stock cast bronze and sintered bronze bearings makes the alteration of a stock item to a special bearing easy and economical. Bunting Cast and Sintered Bronze and Bunting Bearing Aluminum Bars provide the material for special sizes and designs which cannot be made from stock bearings. Your local Bunting Distributor can arrange for such work.

Ask for catalogs . . .

No. 158—Complete listing of sizes of Bunting Cast Bronze and Sintered Bronze Bearings and Bars, and Bunting Bearing Aluminum Bars. Pocket size edition.

No. 258—Complete listing of Cast Bronze Electric Motor Bearings for all makes and sizes of electric motors.

No. 46—Technology of Bunting Bearing Aluminum. A technical treatise on the composition, machining and use of this new bearing metal. Ask your local Bunting Distributor.

The BUNTING Brass and Bronze Company • Toledo 1, Ohio
Branches in Principal Cities

BEARINGS, BUSHINGS, BARS AND SPECIAL PARTS OF CAST BRONZE, SINTERED METALS OR ALUMINUM ALLOYS

HOW MUCH COULD YOUR SHOP PRODUCE *IN A TWO HOUR DAY...*

...*LESS* A COFFEE BREAK?

MMT=PE

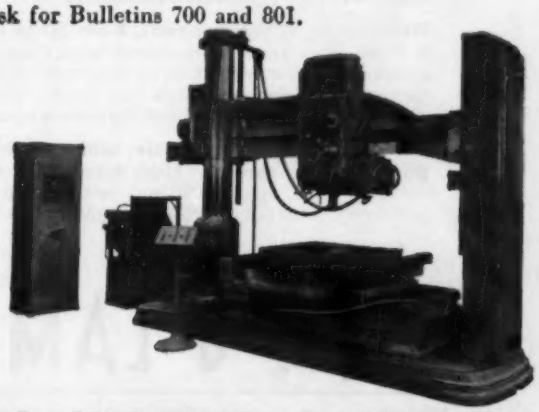
Almost as much as you now produce in 8 hours with conventional equipment! When you switch to an AMERICAN numerically controlled Positioning Table and the new AMERICAN Hole Wizard Radial Drill, your production will step up 400%!

In addition to fast, error-proof positioning to ± .000250", the AMERICAN positioning table gives you extreme ease of operation. The simply loaded punched tape is read by low pressure air, and automatically moves the table to first position at the touch of a button. After that, your operator need only touch the "Next Position" button on the portable console.

This rugged, profit-making combination was designed by American Tool Works and Sperry Gyroscope engineers to increase your production, eliminate expensive jigs, prevent operator error.

Ask your American Distributor about "Toolease," our leasing plan under which this AMERICAN Positioning Table and AMERICAN Hole Wizard Radial combination can improve your production... while it pays for itself. Or, write Section 163 at the address below.

Ask for Bulletins 700 and 801.



THE AMERICAN TOOL WORKS COMPANY

PEARL STREET AT EGGLESTON AVENUE • CINCINNATI 2, OHIO

CIRCLE 176 READER SERVICE CARD

• New Grinding Features . . .
• New Grinding Efficiency

The J&L Model E-2 Automatic Form Grinder

with PERPETUAL FORM CONTROL through a full 12" width!

J & L's new Model E-2 Automatic Form Grinder offers a combination of features that add up to unprecedented production efficiency.

Wide range of work speeds, from 50 to 1500 R. P. M. New unitized headstock has a constant-speed AC motor, with fast cycling achieved by means of an electric clutch and brake. Proper surface speeds available for all diameters up to 8".

Completely automatic cycle, with automatic positive size control. High-speed approach, variable feed, spark-out and withdrawal are positively controlled through simple cam action. Wheel slide is held against a positive stop with uniform hydraulic pressure.

All kinds of wheel trueing, including PFC through 12" width. All types of J & L diamond dressers are available. Also, crush dressing for wheels up to 4" in width. In cemented diamond particle cutters for continuous wheel forming, there are sensational new capacities up to 12" wide.

Capacities up to 31", for precision shaft work. Swivel-type platen up to 15°. Up to 31" between centers. Equally suitable for chuck work.

For detailed information, write today for Form 5916.

JONES & LAMSON

MACHINE TOOL DIVISION

Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vermont

MORSE TOOLS HELP BUILD THE HEAVYWEIGHTS

Long-lasting, quality Morse Tools give Hough smoother holes . . . increased production . . . lower maintenance

Dependability, improved performance . . . these are the outstanding features of The Frank G. Hough Co.'s Payloader, Paymover and Paylogger tractors.

It's small wonder they turn to Morse for cutting tools to help build these quality products. Morse Cutting Tools are known throughout industry for their lastability . . . their quality . . . their capacity to machine faster, smoother, more accurately.

Let Morse help you with your cutting tool problems. Call your Morse Franchised Distributor today. He's the man with the answers.

MORSE

means "THE MOST" *in Cutting Tools*

MORSE TWIST DRILL & MACHINE CO., NEW BEDFORD, MASSACHUSETTS

Warehouses in: NEW YORK • CHICAGO • DETROIT • DALLAS • SAN FRANCISCO

Morse means more production . . . smoother, more accurate production . . . with every type of cutting tool from drills, reamers, taps and dies, to end mills, milling cutters, slitting saws and "specials". So, if you want the best from every cutting tool you buy, mark your order "MORSE". For if you want *Morse Quality*, there's only one way to get it . . . *specify Morse.*

VN

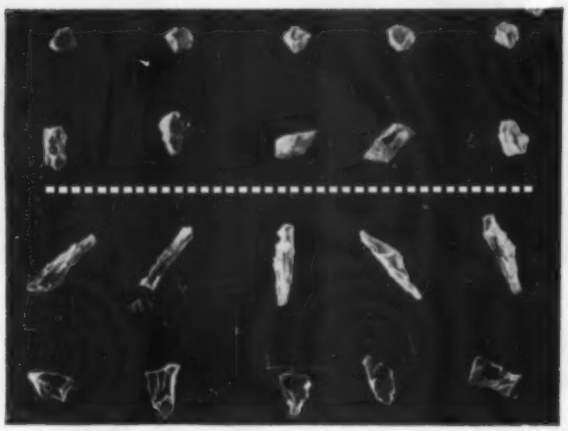
A Division of VAN NORMAN INDUSTRIES, INC.

SND — a new natural diamond

SND—THE LATEST TECHNICAL DEVELOPMENT FOR IMPROVING CARBIDE GRINDING PERFORMANCE

SND (Selected Natural Diamonds) is a *New* natural diamond abrasive developed especially for resinoid bond grinding wheels. It is made up of needle shaped grains and thin, flat platelets selected from diamond boart that has been crushed by a special method.

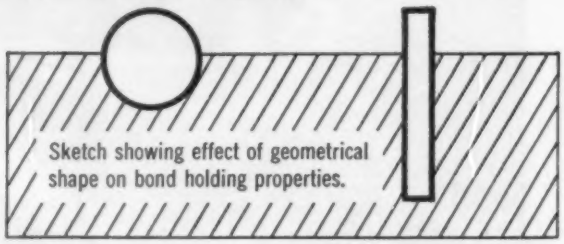
Diamond particles at least twice as long as they are wide are classified as "needles," and particles that are less than one-quarter as thick as they are wide are classified as "platelets."



Top: Blocky diamond particles predominating in conventional grit.

Bottom: Needle and platelet diamond particles predominating in new SND Selected Natural Diamond grit.

Why "needles and platelets"?



Sketch showing effect of geometrical shape on bond holding properties.

For many years, blocky shaped diamond particles were considered ideal for any type bond grinding wheel. Recent laboratory research into the influence of particle shape on grinding efficiency proved that blocky particles were *not* as efficient in resinoid bond wheels as were thin, flat and needle shapes.

Subsequent tests bore out the important facts that, blocky shapes either wore down level with the matrix, or were pulled out of the bond; while needles and flats seldom pulled out, and instead of wearing smooth, tiny bits broke off in a manner which constantly exposed new, sharp cutting diamond edges to the work.

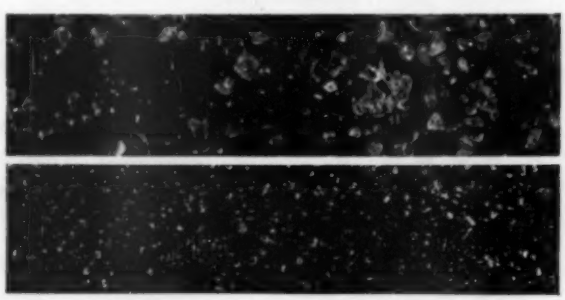
Tests verified by sludge analysis

Analysis of the sludge and swarf collected after tests of both SND and conventional grit wheels verified the test findings. Only uniformly tiny diamond particles were found in residue from SND wheels, proving that each SND particle was almost wholly utilized in the grinding process.

Conventional natural diamond grit sludge ▶

The absence of large particles in SND—Selected Natural Diamonds sludge shows *why* SND gives up to 30% longer wheel life and increased wheel efficiency over conventional diamonds.

SND-Selected Natural Diamond grit sludge ▶



grit for higher grinding efficiency!

How SND (Selected Natural Diamonds) increases grinding efficiency

SND provides more sharp cutting edges per carat in the same grit size.

More cutting edges means a faster, cooler cutting wheel that will last up to one-third longer than resinoid wheels made with conventional grit.

The thin needle and flat grains in SND possess the right amount of natural strength, yet break down easily for fast, free, and continuous cutting.

SND grit offers maximum holding surfaces to the bond, reducing non-productive pull-outs.

SND sharper cutting edges reduce wheel loading and glazing.

Proved in laboratory runs . . .

Extensive laboratory runs show SND grit is up to 30% more efficient than conventional grit when grinding cemented carbide at .0005″ to .0015″ in-feeds and speeds of 5500 S.F.M.

Proved in the field

Many metalworking plants now are proving the new SND grit in their own shops with results that substantiate the already-completed laboratory evaluations.

TREATED SND—ANOTHER NEW GRIT DEVELOPMENT!

A process for treating SND (Selected Natural Diamonds) grit to make it even more friable and to give it superior bonding properties in resinoid wheels also has been developed. This process introduces surface irregularities in the otherwise smooth planes of the SND particles; these tiny cracks and crevices promote faster breakdown after wear and stronger bonding. Already proved to be more efficient than conventional grit at feeds of .0005″ to .0015″, on carbide, Treated SND is recommended only for lighter feeds, and where the nature of the work demands rapid grit particle breakdown.

The selection is yours . . .

SND grit—for tough applications.

SND Treated grit—for light feeds and coolest cutting.

Conventional grit—for heavy feeds (.003″ and up) and the recommended material for metal or vitrified bond wheels.

Available now

Your diamond wheel supplier can now furnish you with grinding wheels made with the new SND grit—either treated or untreated—ask him about SND today!

Diamond experience

Ready to discuss your diamond problems are Industrial Diamond Division Field Engineers located in key metal-working centers. These are technical men with natural diamond backgrounds and experience. Field offices are in Boston, Chicago, Cleveland, Detroit, Los Angeles, Newark, New York.

Technical information service

A new and complete technical information service to help keep you abreast of the latest developments in industrial diamond technology has been established. Monthly Diamond Data and Technical Bulletins will be sent you without obligation. Simply send us your name, title and company address.

ENGELHARD HANOVIA, INC.

INDUSTRIAL DIAMOND DIVISION

113 ASTOR STREET • NEWARK 2, N.J.

New, large capacity New Britain bar machines

If you feel you know New Britain bar machines like a book, a word of caution: There's a completely new book! New, basic design that removes limitations formerly inherent in bar machine construction. New power, new speed, completely new capability for imaginative tooling.

And new, large bar capacity. That is the important "new" we want to call to your particular attention here. You can apply New Britain standards of productivity to bar stock as large as 5⅛".

The new, big line of four-, six-, and eight-spindle models:

Model 450. Four spindles, 5⅛" maximum capacity, four independently operated radial cross slides.

Model 635. Six spindles, 3½" capacity, with independent radial cross slide in every position.

Model 826. Eight spindles, 2⅝", capacity. Six independently operated cross slides with the two lower slides exceptionally wide to provide elevating blocks for cross slide tooling in the number 3 and 8 positions.

Inexpensive, disc-type cams provide positive actuation of cross slides. Cross slide and end-working tools on all models are easily accessible. All models have positive spindle carrier lifting, locating and locking. New catalog material will give you further details on these machines. Your New Britain representative can show you how the increased profitability built into them can improve your competitive situation. Plan to see him soon.

THE NEW BRITAIN MACHINE COMPANY

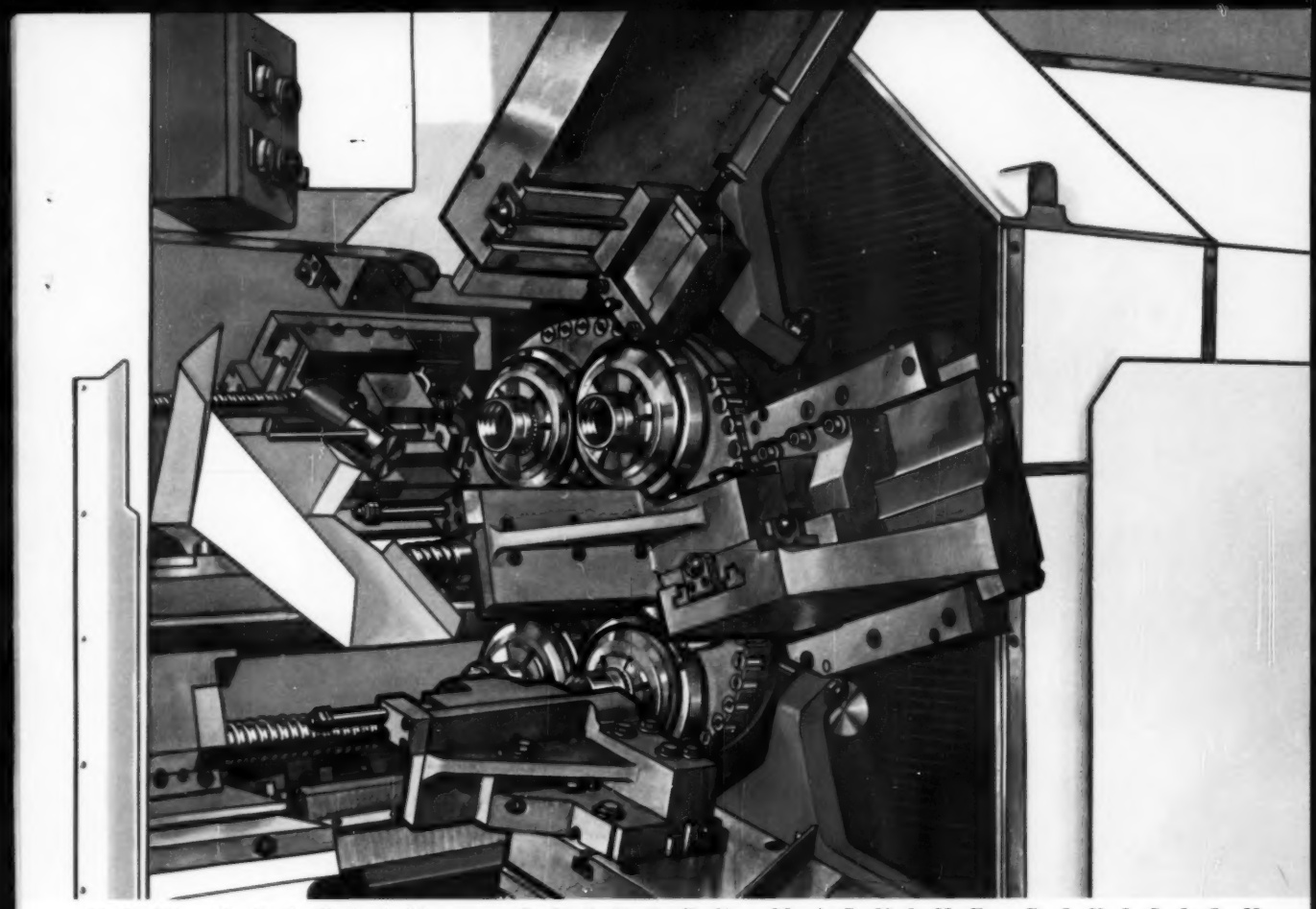
Capacity up to 15" on New Britain chuckers

We are going to take it for granted that *you* take New Britain chuckers for granted—as the leading make of multiple spindle automatics. Most people do. The big news then is that the profitability of these famous machine tools can now be applied to an increased range of work. The new New Britains are available with chucking capacities up to 15", which enables you to apply New Britain standards of speed, accuracy and versatility to larger work.

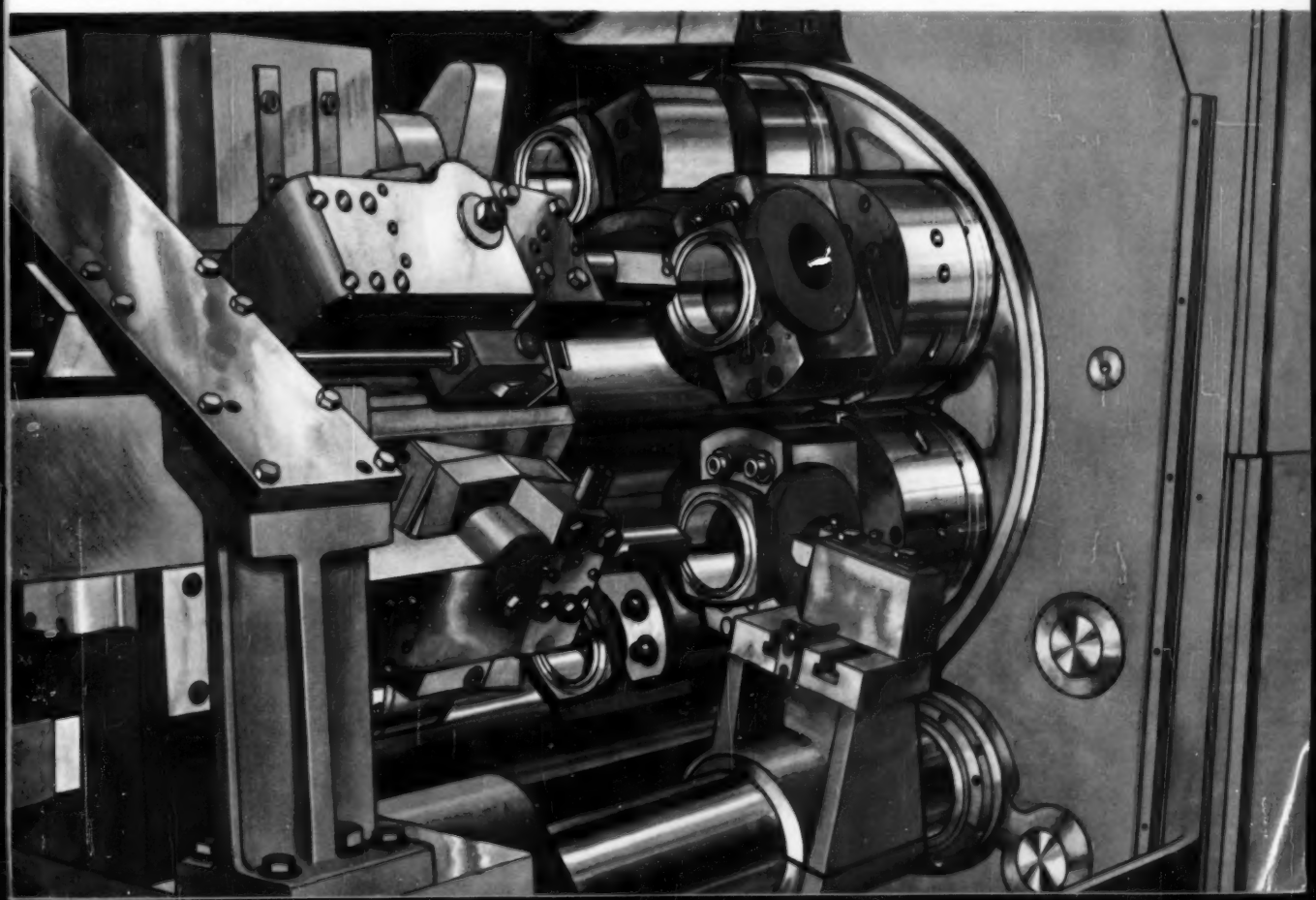
The 15" capacity applies to four-spindle models. Six-spindle machines will take pieces up to 12", and eight-spindle chuckers will handle up to 10".

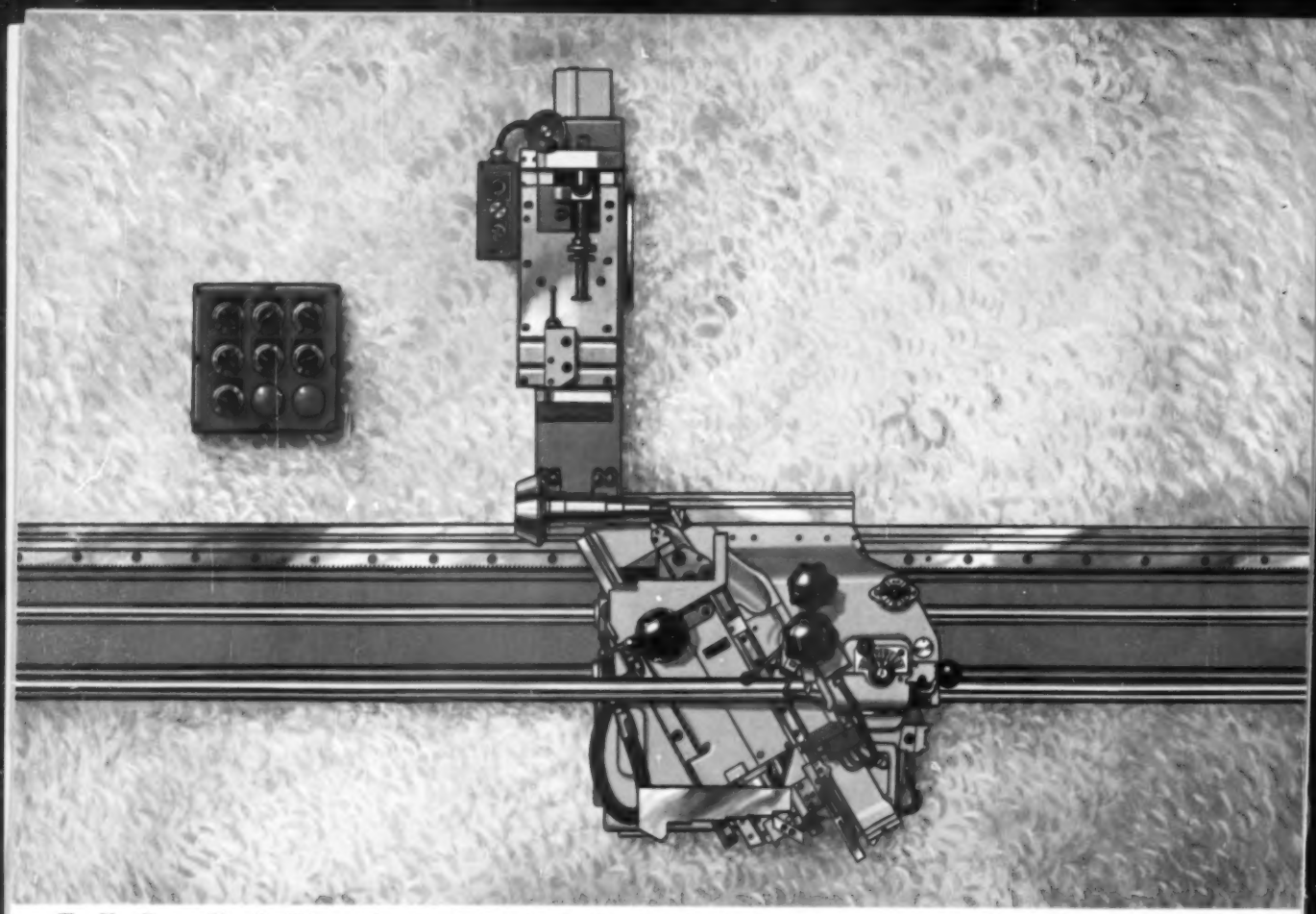
If you work with large castings and forgings, this might be the announcement of the decade, in terms of an investment that can't fail to be profitable. With equipment like this properly adapted to your particular requirements, nobody, anywhere, is going to trim you on cost per piece.

Call on your New Britain sales engineer for practical, specific information, of course. Meanwhile, we have just published a new catalog on these new large capacity chuckers, and we would be happy to mail your copy to you on request. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Conn.

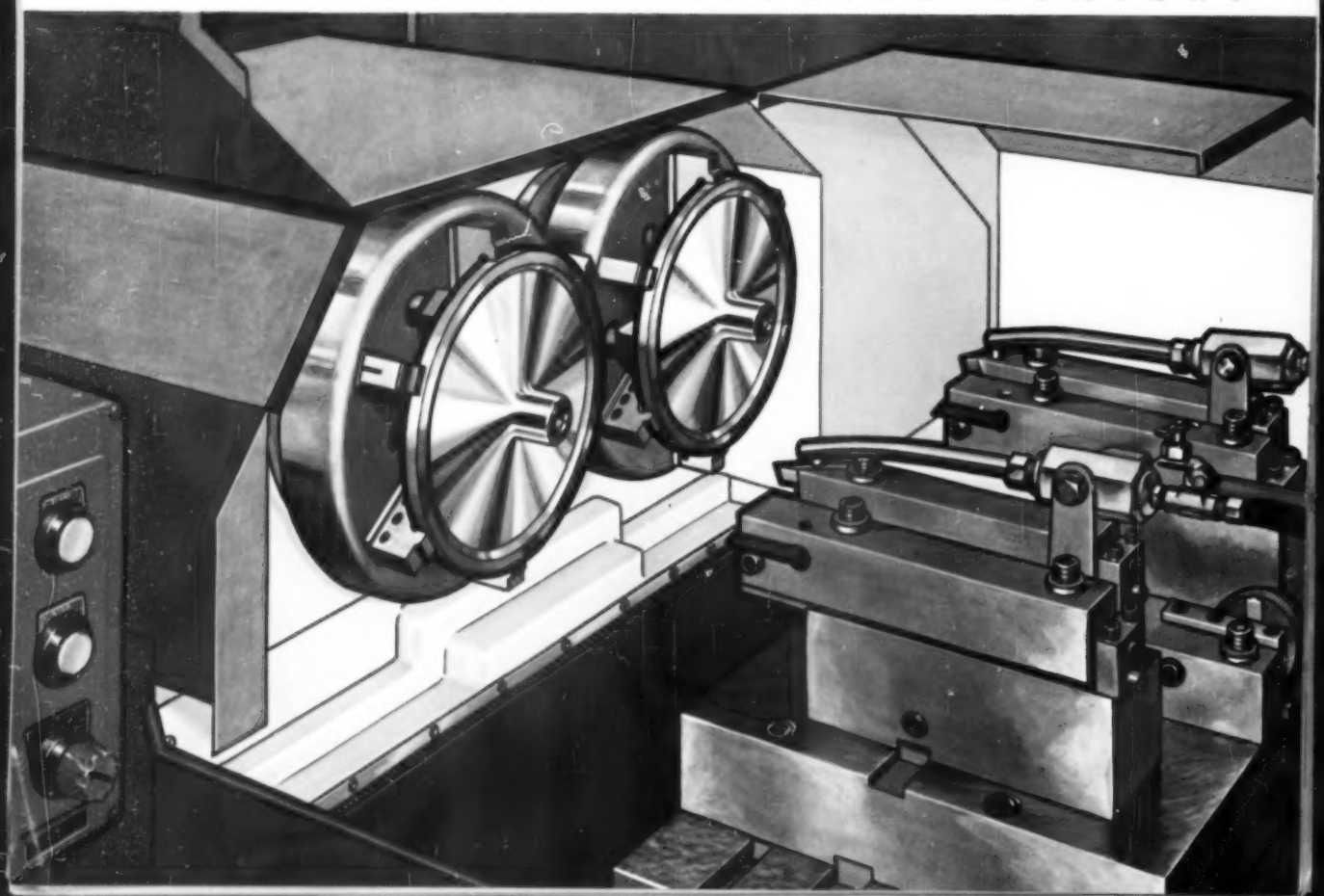


NEW BRITAIN - GRIDLEY MACHINE DIVISION





THE NEW BRITAIN MACHINE COMPANY



Fast, rugged New Britain +GF+ copy lathes

Right from the ground up the New Britain **+GF+** is a machine conceived, designed and manufactured as a copying-contouring lathe. Not a standard lathe with copying attachment; not a factory-made "special" with the contouring feature built on components from other lathes; but a solidly based, ruggedly constructed, fast, powerful, accurate machine designed solely for the template-controlled, rapid production of between-centers or chucked work with external or internal contouring.

A million pieces or just a few, it's a machine you'll use on many different types of short-run jobs (just change the template and reset the controls), or on one long-run job (just replace the single-point tool when it wears).

The instantaneously accurate hydraulic copying mechanism is entirely enclosed within the compact carriage. All controls are within easy reach. The template is up front for easy adjustment. The chips fall free into the wide open base, can't clog or jam any part of the mechanism.

There are endless variations available within the New Britain **+GF+** line. The standard model has applications anywhere on between-centers or chucked pieces. Other attachments and models are available to suit your particular requirements; infeed attachments, automatic loading, bar stock models, etc.

Don't buy any lathe or "special" for copy turning until you have investigated the New Britain **+GF+** copy turning lathe. As a starter, may we send you the latest catalog?

NEW BRITAIN - GRIDLEY MACHINE DIVISION

Consistent accuracy to tenths at super speeds

Model 37 Precision Boring Machine is a machine with a mission, rather than an answer to everybody's metal turning problems. Its mission is contour boring and turning in applications where both extreme repetitive accuracy and high production are of paramount importance. If you have such a requirement, Model 37 is an unbeatable money-maker.

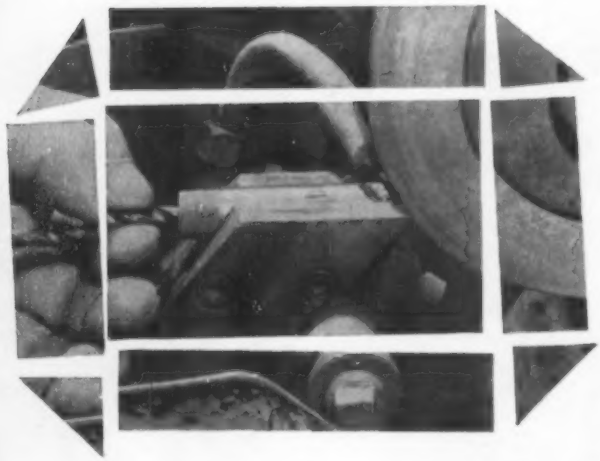
It is an inherently simple machine: simple to operate, with inspection limited to gauging any one dimension. Simple in operating principle, too, built around precision cams that operate without being affected by temperature fluctuation. From one to four high speed spindles can be mounted on a single machine.

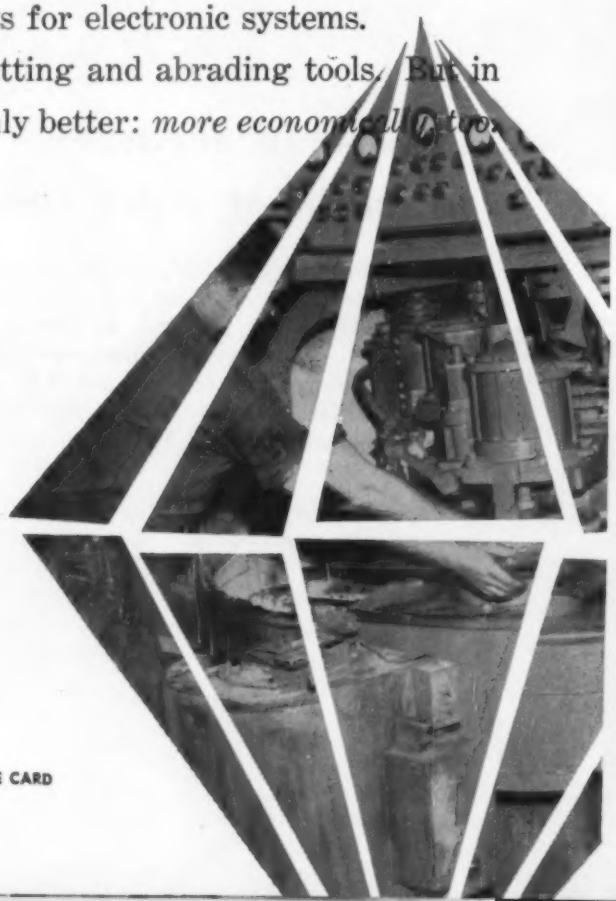
We would be happy to discuss *any* production problem involving straight or contour boring and turning. We doubt that anyone equals New Britain's know-how in this area, and we have a wide variety of boring equipment, both vertical and horizontal and of very advanced design. No matter what your work, or production requirements, this is a very fine place to look for an answer. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

DIAMONDS AT WORK

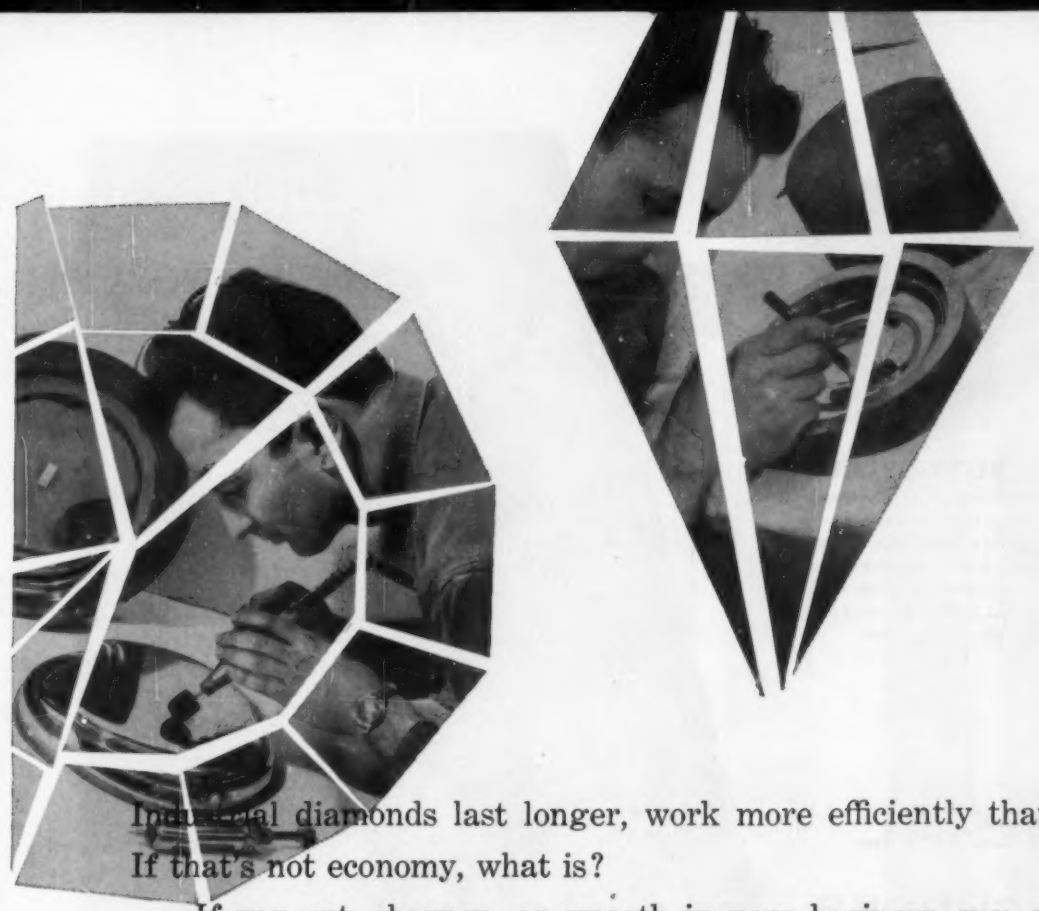
Industrial diamonds are, first and foremost, *tools.* They're used in many ways to do many jobs. Diamonds keep hardest carbide tools sharp and efficient. Diamond wheels shave jet runways to perfect smoothness. Diamond tools speed up production of precision aluminum parts for automobiles. Diamonds machine close-tolerance ceramic components for electronic systems.

These jobs *could* be done with other cutting and abrading tools. But in every case, diamonds do them better. Not only better: *more economically, too.*





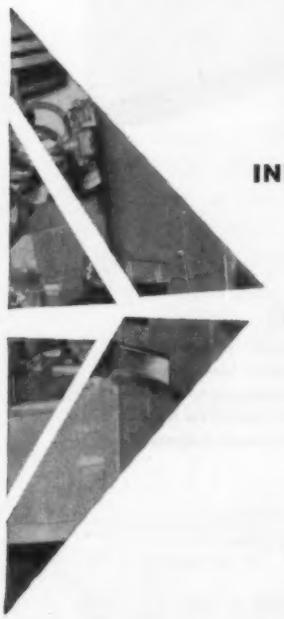
CIRCLE 185 READER SERVICE CARD



Industrial diamonds last longer, work more efficiently than anything else. If that's not economy, what is?

If you cut, sharpen, or smooth in your business, you can probably use diamonds to advantage. Wide assortments are available in any quantity to your diamond wheel and tool maker. See him for more information.

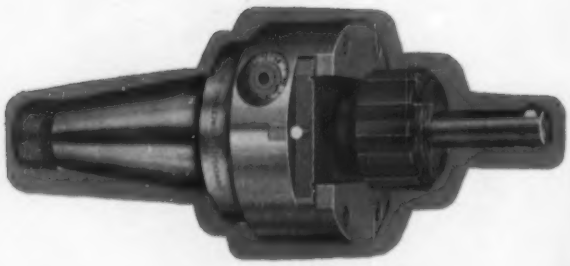
INDUSTRIAL DISTRIBUTORS (SALES), LTD.



INDUSTRIAL DIAMONDS CUT PRACTICALLY EVERYTHING... ESPECIALLY YOUR PRODUCTION COSTS

Industrial Distributors (Sales), Ltd., is the world distributor of natural industrial diamonds . . . the most efficient cutting, polishing and abrading substance known to man. Industrial Distributors sponsors the Diamond Research Laboratory. Its work is devoted exclusively to investigations on all phases of the diamond. The Laboratory stands ready to offer information and assistance to all users of industrial diamonds. Please address your inquiries to: The Diamond Research Laboratory, P.O. Box 104, Crown Mines, Johannesburg, Union of South Africa.

CIRCLE 186 READER SERVICE CARD



UNIVERSAL BORING CHUCK is heavy and rigid for all types of rough boring without chatter yet accuracy of adjustment adapts it equally well to finish boring. Time-tested Universal Collet nose holds boring tool much more rigidly and securely than set screws while precision and extreme accuracy of feed-adjustment are obtained by an anti-backlash arrangement of feed screw and large dial.

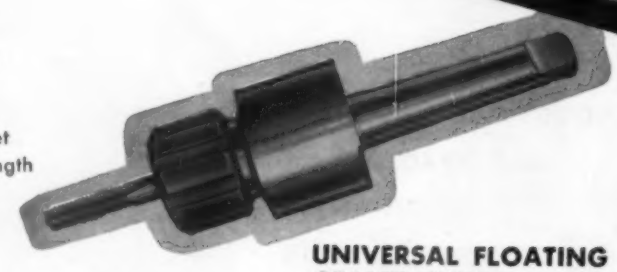
UNIVERSAL RELEASING TAP CHUCK has same basic collet principle featured in all Universal Collet Chucks. Screws or sleeves are not needed and collets are interchangeable with other Universal chucks. Simple, compact design has no springs, cams or pawls to break or wear. Can be used for either right or left hand tapping without adjustment.

HIGH PRESSURE REVOLVING COOLANT TRANSFER CHUCK has standard Universal Collet Chuck nose and a variety of shank sizes can be held by simply changing collets. Minimum overhang is made possible by the single face seal design. Back pressure principle of this design prevents "brake" action thus lowering torque on spindles. Chucks for higher speed and pressures than standard plus a variety of mountings are also available.

UNIVERSAL
COLLET CHUCKS

combine maximum holding power and minimum run out with simplicity of design and low price

The basic collet principle is the same in all Universal chucks. Tools gripped in these chucks withstand a maximum thrust and radial load because the collet grips on a continuous surface its full length and positively locks the tool. Write today for new catalog showing the complete line of Universal collets and chucks.



UNIVERSAL FLOATING COLLET CHUCK for horizontal or vertical operation is positively protected against destructive action of coolant by a seal which prevents entrance of compounds into interior of assembly. Frictionless ball bearing flat springs are adjustable to counter-balance weight of the tool.

219

UNIVERSAL ENGINEERING COMPANY FRANKENMUTH 1, MICHIGAN

6,000

ways
to get extra
efficiency

There are 6,000 different types of Nicholson and Black Diamond files. There's one that's precisely right for your operation ... and the materials you file. • Using the correct file contributes to efficiency by reducing the amount of filing time. Time, not the file, represents the largest part of filing costs. • Nicholson and Black Diamond files pay off another way, too. Their high quality substantially reduces tool replacement costs. • We take infinite care to produce the highest quality files available. You'll find that your Industrial Distributor carries a complete selection under the Nicholson or Black Diamond brand. • The next time you need a file specify Nicholson or Black Diamond for standard or special purpose files ... X. F. (Extra Fine) brand in Swiss Pattern. Ask your distributor's advice ... he'll keep you informed on the various types best suited for your job. Ask him, too, about the newly improved line of Nicholson soft faced industrial hammers.

*Industrial Distributors provide the finest goods and services in the least possible time. Our products are sold exclusively through them.

NICHOLSON

NICHOLSON FILE COMPANY, PROVIDENCE 1, RHODE ISLAND

FILES • ROTARY BURS • HACKSAW AND BAND SAW BLADES • GROUND FLAT STOCK • INDUSTRIAL HAMMERS

Report to the **SMTS*** *Committee*

*SPECIAL MACHINE TOOL STANDARDS

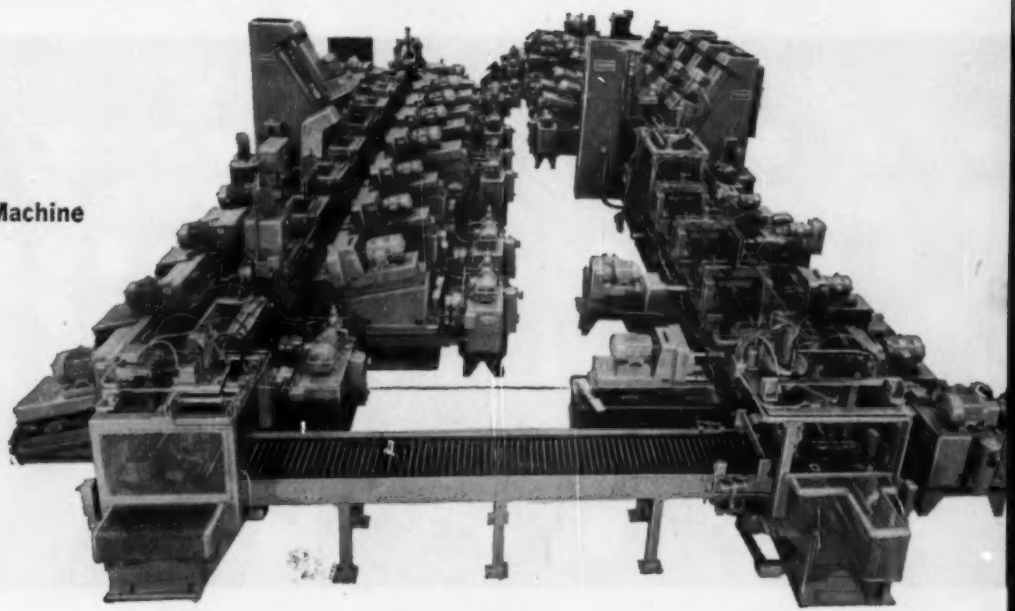
DELIVERY:

MMT·PE SEE SMTS ECONOMATICS • BOOTH 1440 MACHINE TOOL EXPOSITION

BUHR'S "BABY"

arrives on time . . .

Weight: **500 tons**
Length: **220 feet**
Genus: **Transfer Machine**



What's all the excitement about? Buhr's Baby, the first major machine built to the Special Machine Tool Standards, has been delivered to its proud owner—a major American automobile manufacturer. And it's some baby!

A lift-and-carry, part-through transfer, with fifty-eight stations, the machine is designed to perform 323 precision operations in automatic sequence on cylinder heads for a 1961 model automotive engine. Operations, in addition to rough and finish machining, include probing, sealer application, assembling, pressure testing, rejecting and injecting . . . you name it. It's fast, too. The work cycle is only 30.0 seconds. Capacity at 100% efficiency is 120 pieces per hour. It's some baby, alright! Because it was built to the new Standards, it's the most flexible and readily convertible multiple operation machine tool ever built. It's the first in a broad new line of SMTS Babies that Buhr is now building.

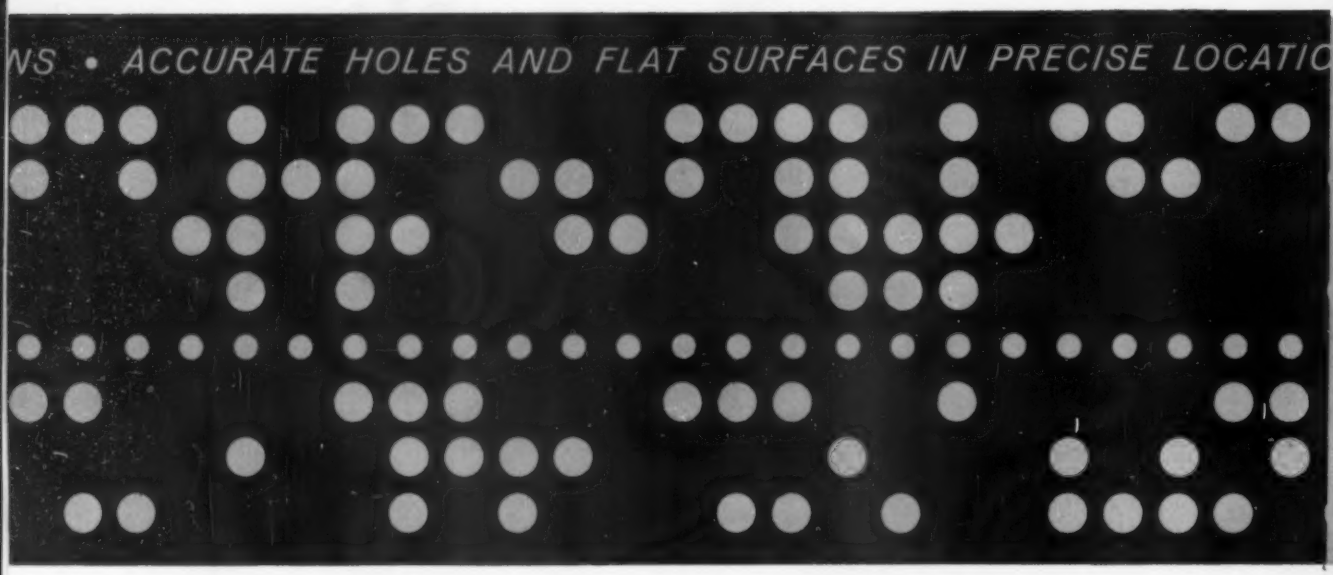
BUHR
(say BURE)
ECONOMATIC

BUHR MACHINE TOOL COMPANY • ANN ARBOR, MICHIGAN

NEW FROM FAIR STREET • HOME OF THE JIGMIL

tapac*

tape control system for DeVlieg Spiramatic Jigmils®



Now available for automatic programming of all Spiramatic JIGMILS, Tapac is DeVlieg's own system of numerical control. And it is so simplified, a tool engineer can master the programming technique in 3 to 4 hours.

Designed to make full use of JIGMIL'S inherent accuracy and precision, Tapac is a point-to-point system for automatic measuring, positioning and cycling complete parts programs utilizing 1" eight-channel standard punched tape input. Automatic functions include sequential or simultaneous positioning of vertical and horizontal slides, spindle depth control cycling and control of spindle speeds and feeds. *Automatic positioning repeats to within 0.0001".* The control system is comprised of simple plug-in electronics and standard proven components.

Come to Fair Street and see the Tapac system of automatic tape control for jigless boring and machining in our own production operations. Its accuracy, precision and flexibility will work equally well for you.

*Trademark—De Vlieg Machine Company

Rewarding revelations in automatic precision await your next visit to Fair Street

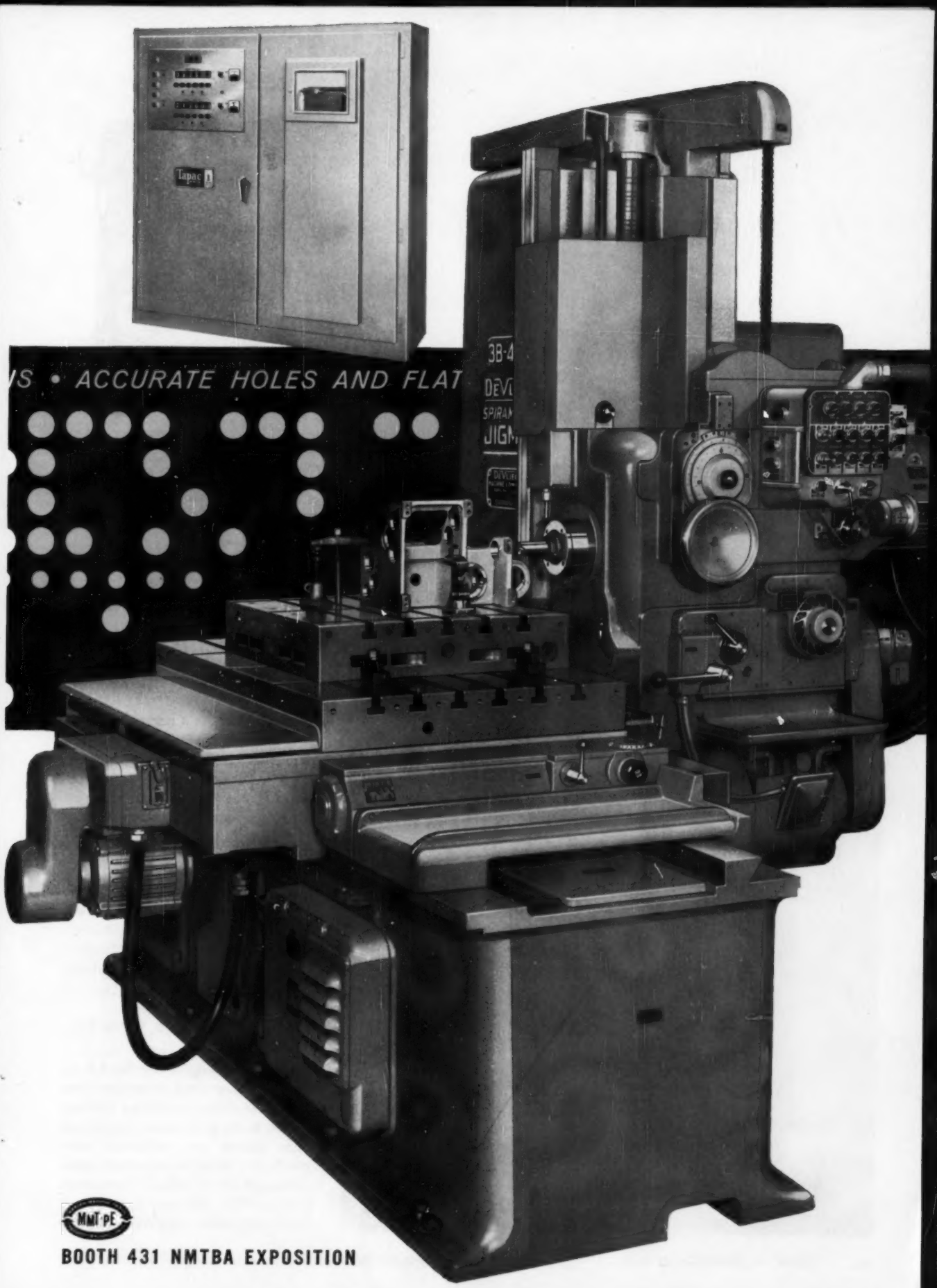
DeVlieg

SPIRAMATIC JIGMILS®

ACCURATE HOLES AND FLAT SURFACES IN PRECISE LOCATIONS

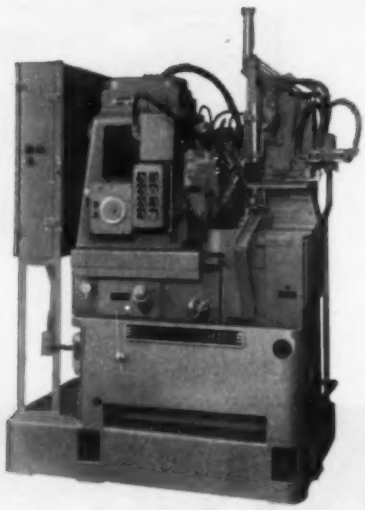
DE VLIEG MACHINE COMPANY, FAIR STREET • ROYAL OAK, MICHIGAN

CIRCLE 191 READER SERVICE CARD



MMT·PE

BOOTH 431 NMTBA EXPOSITION



Compact, high-speed hobbing machine combines many advanced principles of gear cutting . . . for manual operation or complete automation

Whether yours is a general-purpose gear shop or an automotive plant requiring high-volume production, Barber-Colman's new No. 4-6 vertical hobbing machine can give you total gear-cutting economy — low tool cost, faster cutting, increased machine utilization.

Here, in a compact vertical, is the perfect combination of high speed, rigidity, versatility, and automaticity . . . carefully built to Barber-Colman's recognized high standards of precision and extra quality.

High capacity in a versatile machine

Automatic cycling of the No. 4-6 includes carriage feed, retraction after the cut, and rapid carriage traverse to the starting position. Combined high speeds and minimum nonproductive time between cuts make decreased cycle times a practical reality. The machine is designed specifically to be tooled for automatic

High Speed, Versatile Hobbing

...with Barber-Colman's new No. 4-6 Vertical Hobbing Machine

loading. However, it is simple to set up and can be loaded manually when required.

As an example, the 12-14 pitch, nine-tooth automotive pinions (AISI 1024) shown here are hobbed at 240 per hour at 100% efficiency, using a 3" diameter x 4" long triple-thread hob. This job has a feed rate of .045" per revolution, and a hob speed of 362 rpm (284 sfm). Total cycle time for each load of two pinions is 30 seconds.

The machine is automatically loaded ... a shuttle places the blanks, two at a time, under the hydraulically actuated tailstock where they are locked in position against the serrated driver. After the cut, the shuttle unloads the finished work and picks up the next set of blanks.

The automatic hob-shifter is an integral part of the automatic cycle. It can be set to operate after each cycle, or after a certain number of gears has been cut. This assures high gear production and low hob cost.

Rugged design increases productivity

Vertical design of the No. 4-6 — with integral bed, spindle housing, and upright—provides extra rigidity and simplifies application of automatic tooling. The heavy vertical column rigidly supports all motions of the machine. Movements of the column in both directions are controlled by positive stops. Hydraulic pressure holds it firmly against a depth stop during the cut.

MODERN MACHINE TOOLS MMT=PE PRODUCTION EFFICIENCY

See the new No. 4-6 vertical hobbing machine at the 1960 Machine Tool Exposition ... Booth 923.

Close-couple design, with short shafts having high diameter-to-length ratios, minimizes vibration, even under the toughest conditions. Both the hob spindle and work spindle are mounted in precision tapered roller bearings.

These are reasons why the No. 4-6 can offer you maximum hob speed of 614 rpm and maximum feed of .150" per work revolution.

For complete information on how you can gain total gear-cutting economy, contact your Barber-Colman representative or write the factory direct.

Barber-Colman Company

BARBER COLMAN ®

71 Loomis Street, Rockford, Ill.

CIRCLE 194 READER SERVICE CARD

RUGGED to full tool capacity!

...FOR LONG WORKING LIFE TO ELIMINATE DOWNTIME & PRODUCTION LOSSES!

THOMSON

THRIFTMASTER DRILLHEADS

DRILL • TAP
REAM • BORE
COUNTER-BORE
COUNTER-SINK
FACE

Tremendous economies from the use of multiple-spindle drillheads are obvious. Use *THOMSON* THRIFTMASTER Drillheads for optimum performance and profits. *Ask NOW for our new catalog.*

THRIFTMASTER
PRODUCTS CORPORATION

1016 NORTH PLUM ST.
LANCASTER, PENNA.
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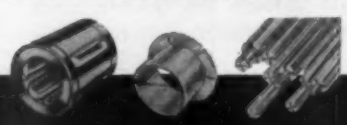
Also Makers of DORMAN AUTOMATIC REVERSE TAPPERS



Subsidiary of
THOMSON INDUSTRIES, INC.
makers of BALL BUSHINGS • NYLINERS • 60 Case Shafting

3 WAYS YOU CAN KEEP AHEAD OF COMPETITION

A BETTER PRODUCT . . . AT LESS COST . . . through ADVANCED GAGING!

Profit margins aren't getting any better . . . just the opposite. It's no longer a matter of "getting the stuff out". The problem now is making it *better at lower cost.* Advanced gaging—by FEDERAL—can do it. The gaging ideas are proven profit makers. The gages, far from being monsters of automation, are compact, standardized units, realistically designed to provide automatic control or inspection, or both, where it does the most good and at a price that almost *every* manufacturer can afford. And they have reliability . . . the most important single feature of FEDERAL Gaging.

Whether you're big or small in terms of production, *at least one of these gaging arrangements can pay off for you.* It's the truth. Ask us to prove it. Write:

FEDERAL PRODUCTS CORPORATION
6127 Eddy Street • Providence 1, Rhode Island

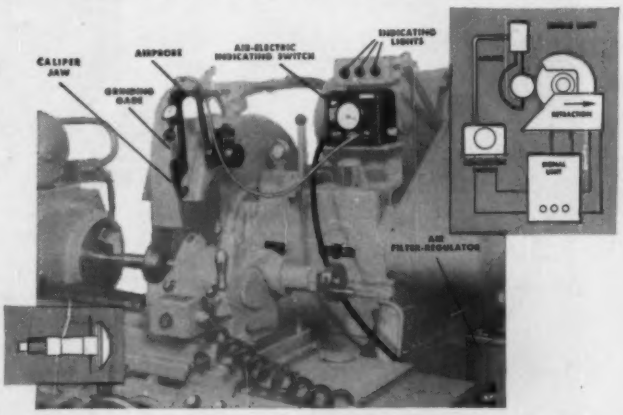
❶ AUTOMATIC CONTROL OF FINISH SIZE

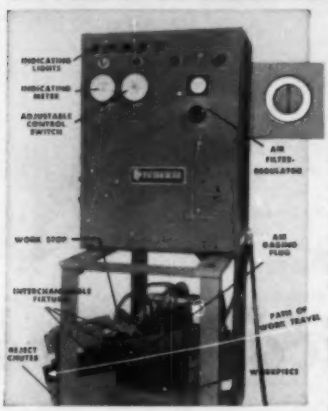
This standardized control gage continuously measures and indicates size of work as it is being ground and automatically causes wheel to retract the instant finish size is reached. Unit can be easily applied in the field to any center type grinder having hydraulically controlled wheel slide.

BENEFITS: Reduces costs — one operator handles two, possibly three grinders performing the same or different operations. Gages pay for themselves within a few months.

Improves quality — even if you have only one grinder, gage is a profit-maker because it eliminates error due to operator inattention or fatigue and also eliminates cost of later inspection.

VARIATIONS: Similar FEDERAL Gages are available through machine tool manufacturers to change wheel feed rate to dwell grind also . . . or to control dressing cycle and finish size on I.D. grinders. When specifying machine tool requirements be sure to include Federal gaging.



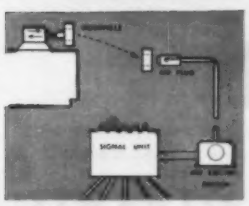


❷ AUTOMATIC 100% INSPECTION

This standardized "post-process" gage inspects every part as it is discharged from the machine and sorts work into "good", "*near*-over", "*near*-under" plus "salvage" and "scrap", indicating the size of each piece. Operator can compensate for drift and piece-to-piece variation *before any scrap parts are produced.* Can be applied to any type I.D. or O.D. grinder, lathe, boring machine or screw machine.

BENEFITS: Lower cost per part. Virtually eliminates scrap by showing trend *before* tolerance limits are reached.

Eliminates inspection errors — gage has 99.8% reliability or better.



VARIATIONS: Federal Gages of similar type are available through machine tool manufacturers to also provide automatic compensation of the machine, either proportionally or by increments, so that drift is corrected without need for operator attention. Be sure to specify Federal Gaging when buying machine tools.

❸ SEMI-AUTOMATIC, MULTIPLE DIMENSION MEASUREMENT

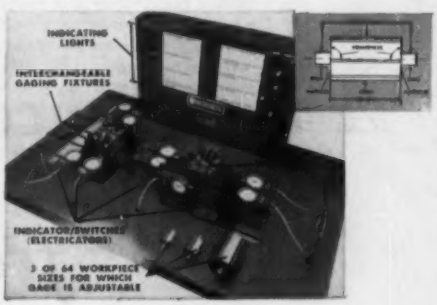
Ideal for small and medium production manufacturers, this gage checks nine dimensions in two stations and is adjustable for 64 sizes! Work is loaded and disposed of manually. Lights show "good", "over" and "under".

BENEFITS: Reduces non-productive costs—inspection time per part is reduced 75%.

Improves quality level. Permits profitable 100% inspection.

Inspection can be performed by less skilled personnel.

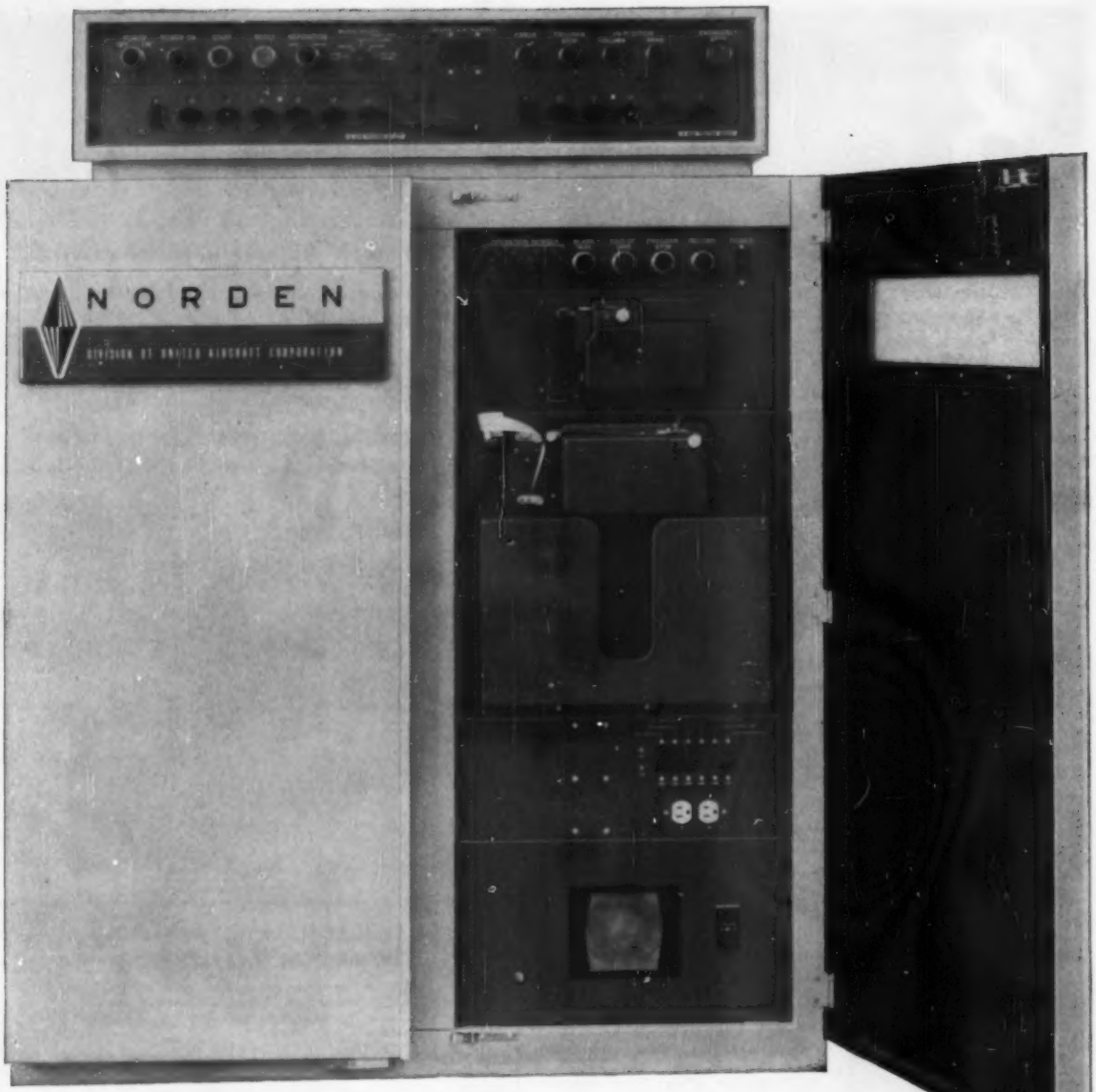
VARIATIONS: Can be designed to provide virtually any combination of dimensional measurements. Unit can incorporate semi-automatic disposal. Other design possibilities up to a completely automated inspection and control gage.


INDICATING LIGHTS
INTERCHANGEABLE GAGING FIXTURES
INDICATOR/SWITCHES (ELECTRICATORS)
3 OR 64 WORKPIECE SIZES FOR WHICH GAGE IS ADJUSTABLE

Ask FEDERAL *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging



A new concept in Numerical Control

from ★ NORDEN ★

DIVISION

NORDEN Modumatic Control Systems feature display of actual position

With Norden unique components you can automate as much or as little as you need. This new concept in numerical control is made possible by the exclusive design of a position feedback transducer, electronic circuitry and visual display. These units are available in various systems to show the exact position of the moving members of a machine at all times.

EXACT POSITION READOUT

Series 100—This system displays in straight decimal form the exact position of the tool or work piece. One display is used for each axis of motion.

Features—Illuminated numbers, readable from twenty feet—individual plug-in decimal units—display unit can be located on machine or remote.

AUTOMATIC POSITIONING

Series 600—A completely automatic positioning system with input from either manual dial-in switches or punched tape. Display units provide decimal readout of actual position—not command.

FULL RANGE ORIGIN SELECT

Both **Series 100** display and **Series 600** positioning systems can be supplied with full range electronic origin select. Any desired offset is quickly and easily dialed in by the operator on manual selector switches

Features—Eliminates time consuming readings and calculations—eliminates human error—provides offset calculation automatically—displays exact position numerically.

CONTROLLED PROGRAMMING

These systems are available with automatic tape punch units for tape preparation "on the machine." This provides a permanent inspection record or a programmed tape for playback applications.

PROGRAMMED DIMENSIONAL INSPECTION

This new Norden concept now makes possible automatic inspection of parts by measuring their exact shape and contour. Since each point on the part's surface has a digital value this information can be easily programmed. Corresponding points on the actual part can be probed automatically and their dimensions compared with the programmed information. The system can be provided with direct numeric print or readout of actual dimensions, deviations from nominal, or out of tolerance indications. In addition, punched tape output is available.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

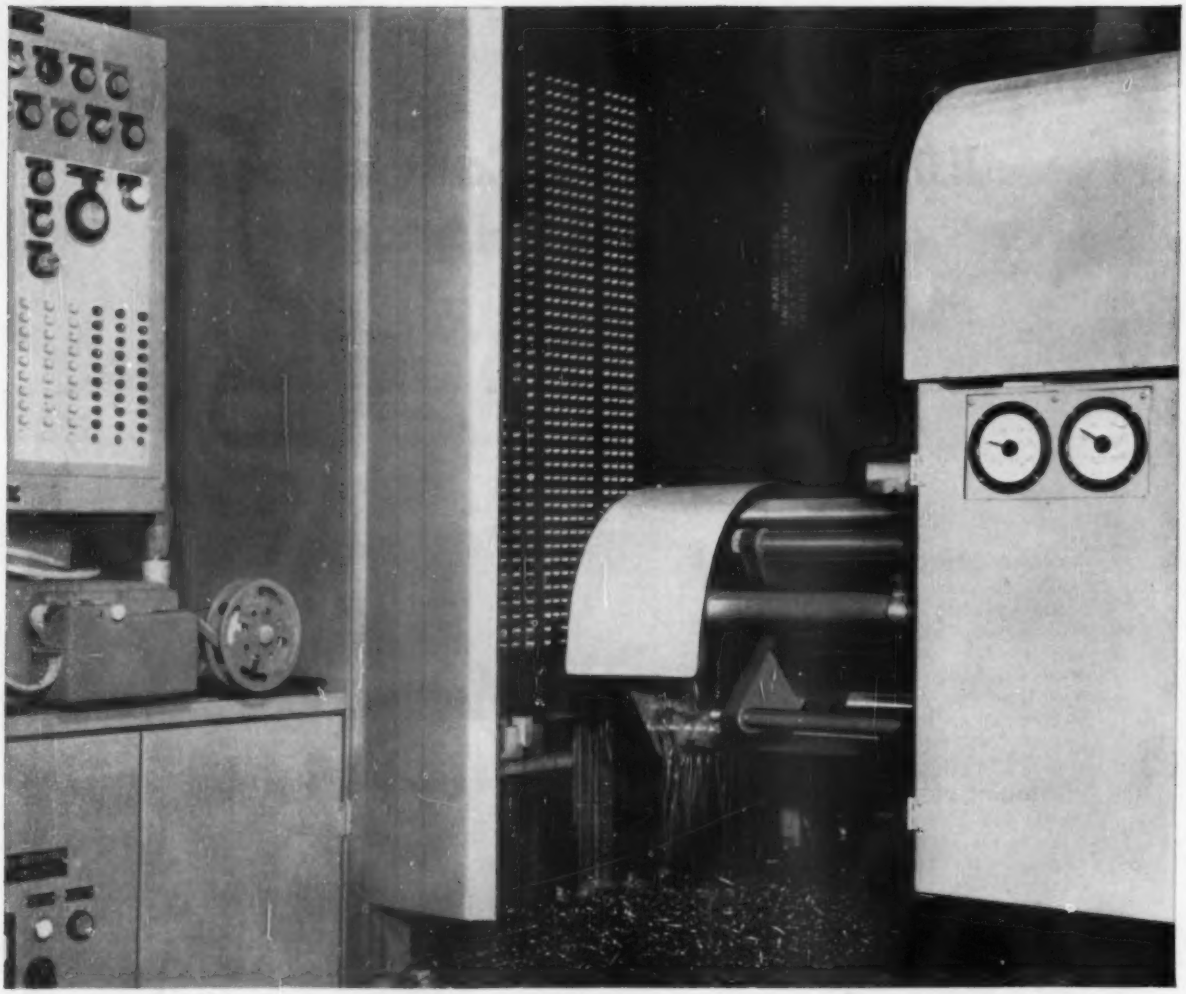
When in Chicago see us at the Production Engineering Show, Navy Pier, Booth 221. At the National Machine Tool Builders Exposition, see Norden Controlled Machines exhibited by G. A. Gray Company, Atlantic Machine Tool Works, LaPointe Machine Tool Company.

For more information contact your nearest Norden Representative, 400 Main Street, E. Hartford, Connecticut, JAckson 8-4811, 11 West Monument Avenue, Dayton 2, Ohio, BAldwin 8-4481, or write us at the address below.

OF UNITED AIRCRAFT CORPORATION

DATA SYSTEMS DEPARTMENT

SANTA ANA, CALIFORNIA



"40 IPM AT *875 RPM*... WE WERE AMAZED"/ *says Walter P. Hill*

DATA:	1020 LEDLOY LEADED PLATE 1½" THICK	1020 NON-LEADED PLATE 1½" THICK
PENETRATION RATE Production Run	40 IPM	20 IPM
DRILL SPEED Production Run	875 RPM	750 RPM
MAXIMUM IPM Test Run	up to 47	up to 28
CHIP CHARACTERISTICS Thickness Temperature Type	.060—.080 cool broken	.040—.060 cool curled

"Ours is a specially designed numerically controlled jig drilling machine with which we obtained penetration rates of 20 Inches Per Minute at 750 RPM in standard half-inch thick 1020 steel plate. However, with the same set-up, we easily obtained 40 IPM at 875 RPM in INLAND LEDLOY leaded steel plate three times as thick and with far better tool life.

■ "Actually, in LEDLOY, we reached penetration rates of 46 and 47 IPM but consider the 40 IPM more practical for production runs. Our programmed test run was made on steady plates for large condensors in which 1½" LEDLOY steel plates were used. As a control, equivalent drillings were made in non-leaded plates of the same chemistry and the same thickness. Our load meter showed the same pulled load on LEDLOY at 40 IPM as we pulled on the non-leaded plate at 20 IPM. Tool life using LEDLOY plates at 40 IPM was equal to tool life using non-leaded plates at only 20 IPM.

■ "We conclude, and without hesitation state, that LEDLOY displayed a marked improvement."

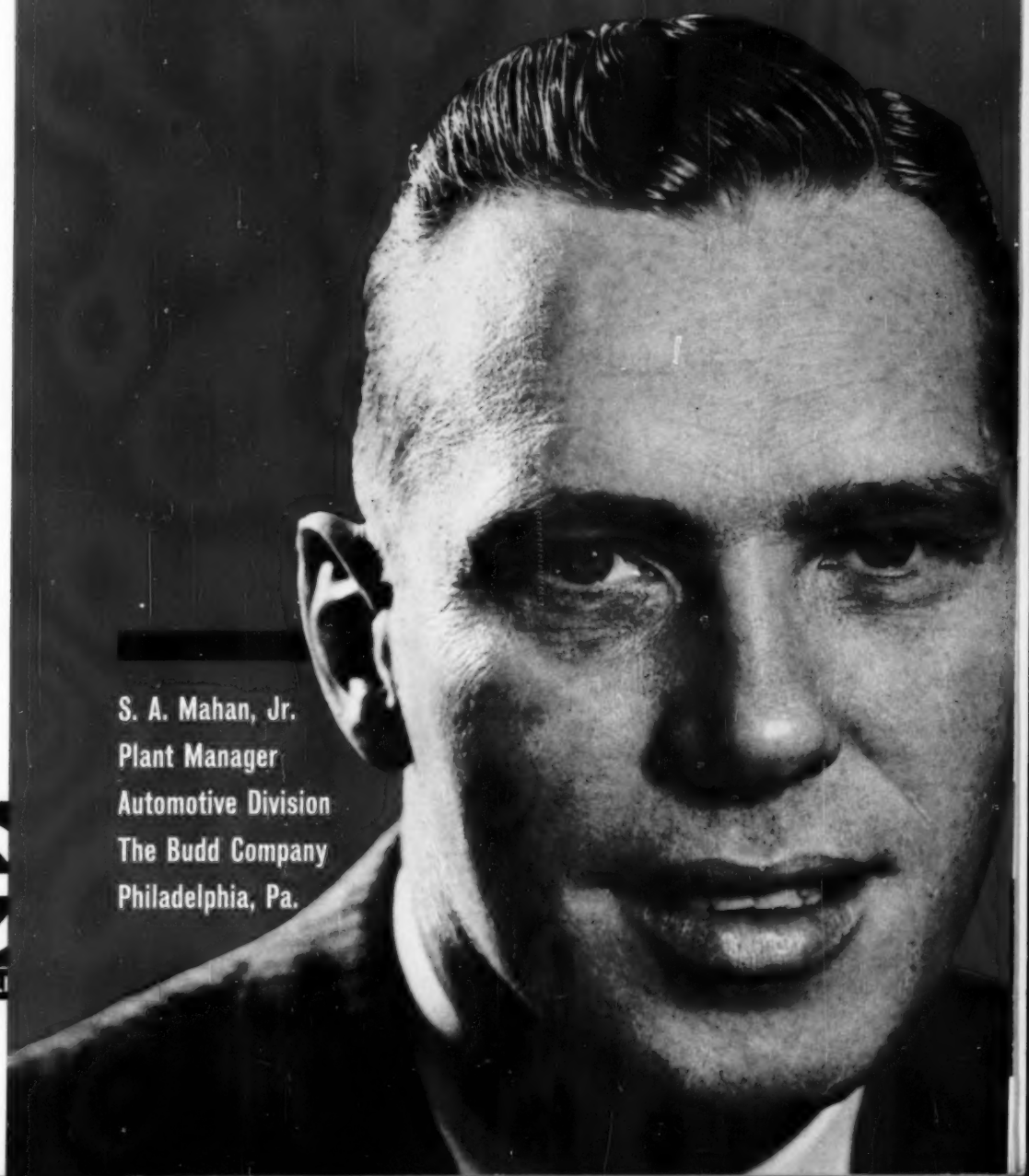
Walter P. Hill, President
WALTER P. HILL, INC.
DESIGNERS AND BUILDERS
SPECIAL AUTOMATED MACHINES
DETROIT, MICHIGAN

LEDLOY®
the world's most machinable steels

INLAND STEEL COMPANY INLAND
30 West Monroe Street, Chicago 3, Illinois

"OUR FIRST TAPE-CONTROLLED MACHINE TOOL HIGHLY SUCCESSFUL

. . . A REAL BREAK-THROUGH IN MANUFACTURING EFFICIENCY."



S. A. Mahan, Jr.
Plant Manager
Automotive Division
The Budd Company
Philadelphia, Pa.

GIDDINGS & LI

ECONOMIC BENEFITS OF NUMERIPOINT* CONTROL AT THE BUDD COMPANY

The management of The Budd Company realized that tape-controlled machining in specific applications would be a means of improving service to customers and reducing manufacturing costs at the same time. As a result, a Giddings & Lewis Numeripoint-controlled horizontal was purchased for drilling, boring, reaming, and tapping die blank holder castings and plates.

The Budd Compa
automobile compone
in Philadelphia, Ga
one of the nation's le
builders for the au
missile industries. I
time, scheduling, c
critical factors.

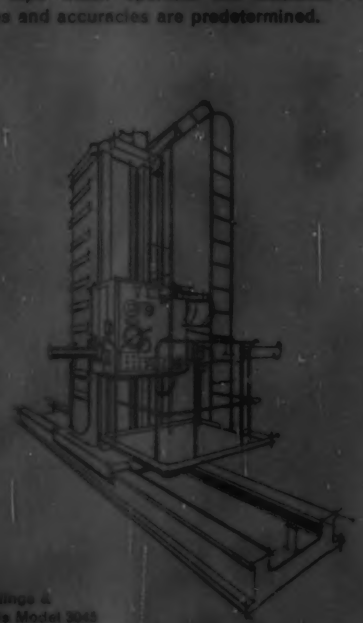
The G&L machin
ments beautifully. H
Jr., plant manager,
rived from it: "Our G
point-controlled ma
successful — has i
saved money, reduce
us to meet tight sch
machine is just a sta
the foundation to go f
controlled machines."

● Here are some of
Mahan's statement a
purchasing, shop, and

*Giddings & Lewis trade name

G & L Numeripoint control is management control . . .

All the machining on a part is programmed by the process technician who "lays out" the piece by means of a written manuscript, establishes sequence of operations, and machine feeds and speeds. His written manuscript is typed out on a Flex-o-writer which punches the tape which operates the machine. Production rates and accuracies are predetermined.



Giddings & Lewis Model 3045 floor-type horizontal boring, drilling, and milling machine used at The Budd Company.

Center drill
and plates

Below — Th
He needs d

GIDDINGS & LEWIS

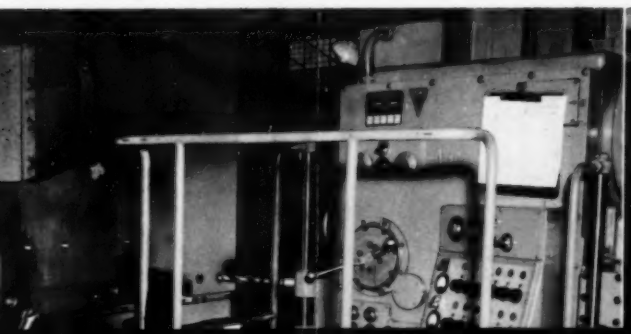
Company — a major supplier of components, maintaining plants a, Gary, and Detroit — also is on's leading die, jig, and fixture the automotive, aircraft, and ries. In this tool business, lead ing, cost, and accuracy are .

machine has met the require- ully. Here is how S. A. Mahan, ager, sums up the benefits de- "Our Giddings & Lewis Numeri- d machine has been highly has improved accuracy and reduced lead time, and helped ht schedules. We feel that this a start — that it has provided to go further into Numeripoint- hines."

me of the reasons behind Mr. ment as summed up by Budd's op, and programming personnel:

- Some jobs that formerly took 29 hours on another type of machine, plus ten hours in layout, now require only 20 hours totally on the G&L machine.
- Expensive layout work and checking of layout are completely eliminated. The need for a crane and riggers to set up work on layout tables also is eliminated.
- Because die blank holder castings and plates now are accurately machined to ± .001" to tolerance from the same tape, parts go together smoothly on the assembly floor with consequent time savings and elimination of reworking.
- It used to take as long to make costly fixtures for some parts as it now does to machine the entire part itself.
- After only three months' experience, the programmer can "tape" a part in a fraction of the time previously required to lay it out.
- Work can be planned more efficiently because programming is done well in advance of production.
- Workpieces with many common operations or hole patterns can share a master tape — only the differences need to be programmed individually.
- Once programmed, work can be accurately duplicated any time, with any machine operator, and with no lead time for layout involved.
- Each tool is handled only once; fast positioning permits all identical operations to be performed before changing tools.

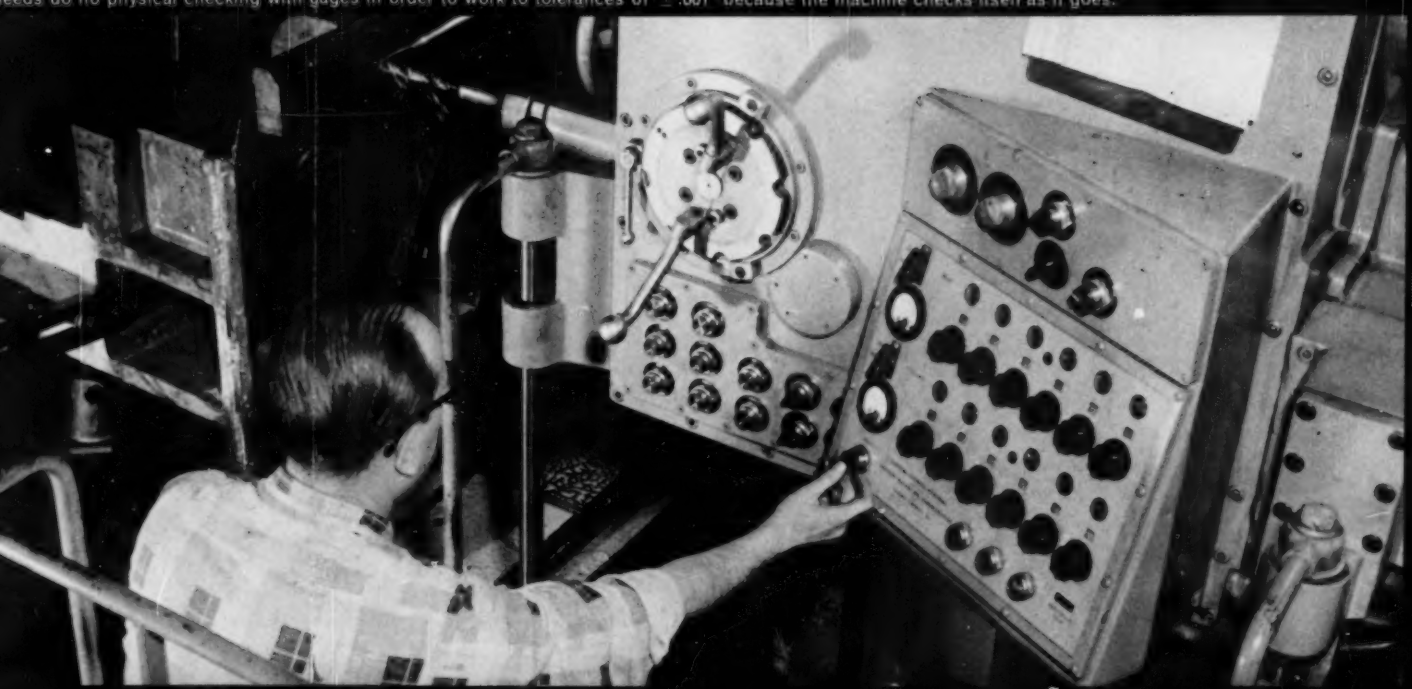
The benefits that The Budd Company has secured are typical of those being experienced wherever G&L tape-controlled machines are in use. For a complete analysis of what this equipment might do for you, consult your local G&L distributor or write for information.



ter drilling, drilling, chamfering, and tapping in blank holder castings plates are accurate on center lines within ± .001" from end to end.

Manuscript and punched tapes for the Giddings & Lewis Numeripoint-controlled machine are easily produced on a Flex-o-writer.

w — The operator has complete supervision of the machine through the control system — the readout system tells him the exact position of his tool. eeds do no physical checking with gages in order to work to tolerances of ± .001" because the machine checks itself as it goes.



FIRST tape-controlled contour milling machine . . . *FIRST* tape-controlled vertical boring mill . . . *FIRST* tape-controlled vertical turret lathe . . . *FIRST* tape-controlled die sinking machine . . . *FIRST* tape-controlled horizontal boring, drilling, and milling machine . . . *FIRST* machine tool builder to develop and manufacture its own numerical controls . . . *FIRST* and only builder to provide programming and magnetic tape preparation service for customers . . . *FIRST* builder to offer both path and point control . . . *FIRST* builder to use tape-controlled machine tools in its own shops.

EXPERIENCE
TO HELP YOU INTO TAPE

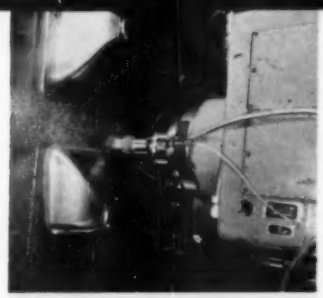
from the people who developed the first commercially available tape-controlled machine tool

The decision to go into tape depends upon a number of economic and manufacturing considerations. You can come with confidence to Giddings & Lewis to discuss these considerations.

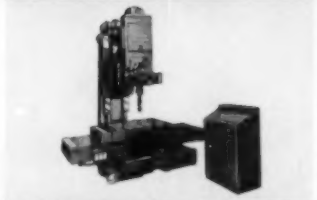
Giddings & Lewis pioneered tape-controlled machine tools . . . has produced more major machines with numerical control than any other builder . . . has developed its own control systems . . . uses tape-controlled machines extensively in its own shops . . . and has established a numerical control research, development, testing, and programming center unique in the industry.

Giddings & Lewis machine tools are available with G&L Numeripath* magnetic tape continuous-path control or G&L Numeripoint* punched tape discrete positioning control, as well as with other makes of control systems. These machines are specifically designed and manufactured to be operated under tape.

For experienced answers to your tape-control questions, consult your Giddings & Lewis distributor or the factory. Literature available upon request. *Giddings & Lewis Machine Tool Company, Fond du Lac, Wisconsin.*

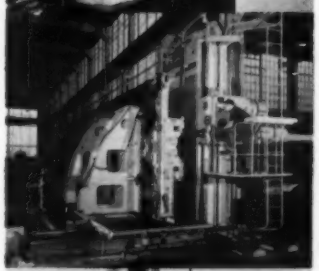


CONTOUR MILLING MACHINES



POSITIONING TABLES

VERTICAL TURRET LATHES



FLOOR-TYPE HORIZONTALS

TABLE-TYPE HORIZONTALS

VERTICAL BORING MILLS

GIDDINGS & LEWIS

GIDDINGS & LEWIS

GIDDINGS & LEWIS MACHINE TOOL COMPANY, Fond du Lac, Wis.

Horizontal boring, drilling, and milling machines; vertical turret lathes; vertical boring mills; positioning tables; die sinking machines; contour milling machines; radial and upright drilling machines; planers; planer mills; numerical and tracer control systems; Davis boring tools.

*Giddings & Lewis Tradenames

H-202 Printed in U.S.A.

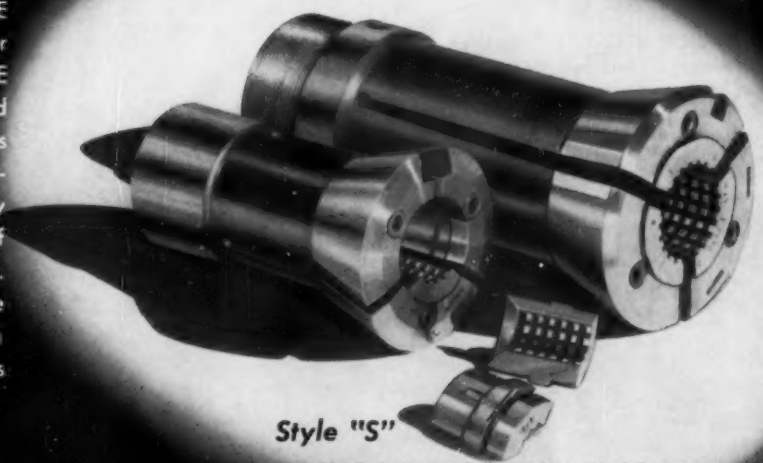
HARDINGE
ELMIRA, N.Y.

TO GET *Better Performance* and *Better Production*

Greater Accuracy Quicker Set-Up
Longer Life Less Scrap Lower Cost

You start off right when you order your Automatics equipped with HARDINGE Style "S" Sure-Grip Master Collets and HARDINGE Style "B" Master Feed Fingers. Replaceable pads save up to 80% and performance is proved by years of use in thousands of screw machine departments.

For better performance at lower cost, standardize on HARDINGE Master Collets and Master Feed Fingers.



Style "S"

The Only Master Collet With No Work Pressure On The Screw

Style "B"

Pads Cannot Work Loose
No Screws — No Pins

AVAILABLE FROM STOCK

for

ACME-GRIDLEY
CLEVELAND
CONE
GREENLEE
GRIDLEY
NATIONAL ACME
NEW BRITAIN
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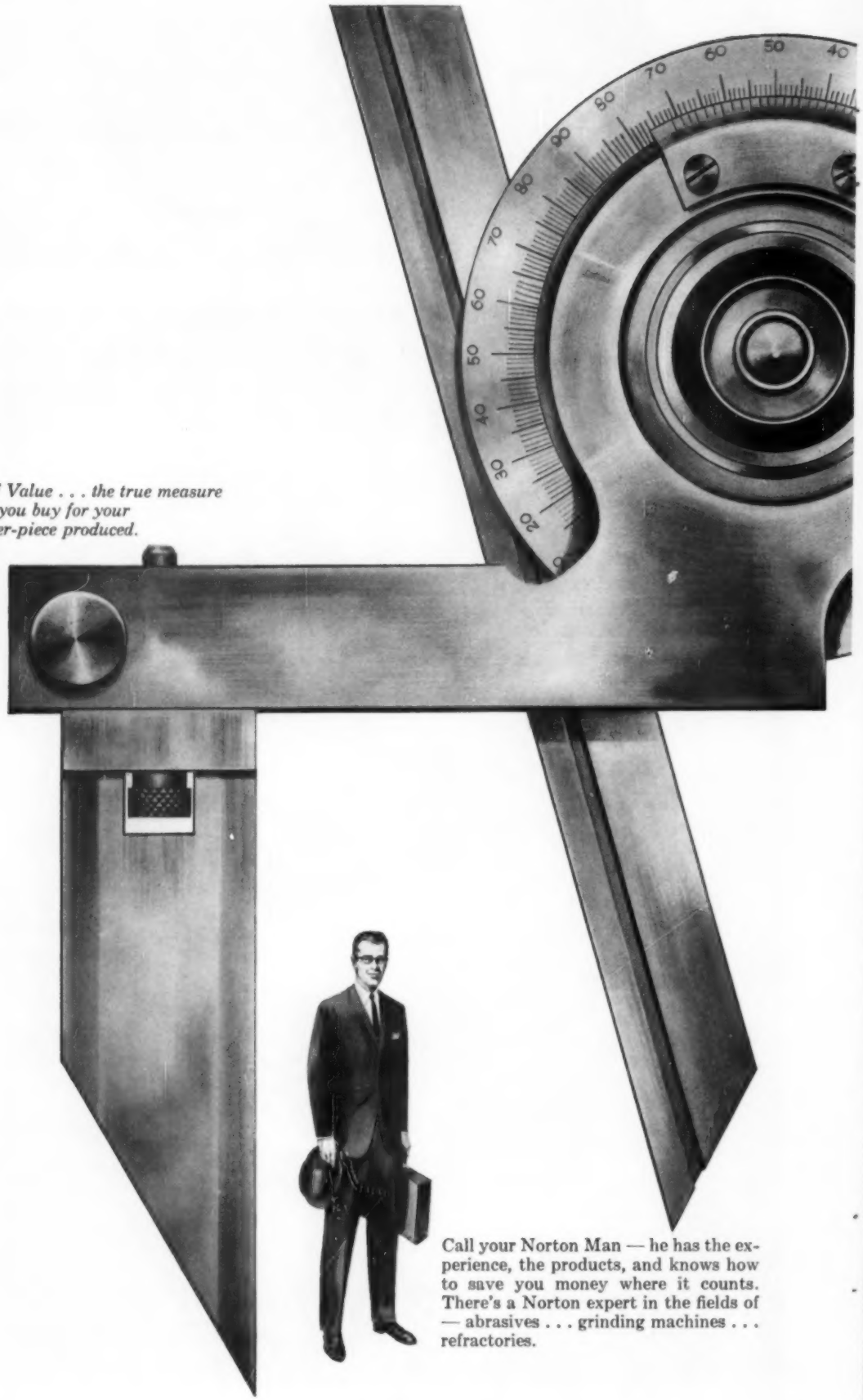
HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Collet stocks are available in Atlanta, Boston, Chicago, Dayton, Detroit, Elmira, Hartford, Los Angeles, New York, Philadelphia (Yeadon, Pa.), Seattle, Portland, Minneapolis, Oakland, St. Louis, Springfield, N. J., and Toronto, Canada.

◄ CIRCLE 203 READER SERVICE CARD CIRCLE 204 READER SERVICE CARD

The Norton Measure of Value . . . the true measure of savings on materials you buy for your production is the cost-per-piece produced.



Call your Norton Man — he has the experience, the products, and knows how to save you money where it counts. There's a Norton expert in the fields of — abrasives . . . grinding machines . . . refractories.

You can produce greater savings than you can buy

It is not how much you spend, but what you receive for your money that determines a bargain.

The economic truth of the above statement applies to all manufacturing and is especially true in grinding wheels.

There are cheaper grinding wheels than Norton wheels — and on the invoice they may look like a bargain. But if the wheels purchased fail to perform efficiently on the production line or incur production delays because of poor quality or misapplication — a higher cost of production is the price actually paid.

In brief, *the true measure of grinding wheel value is not how much you paid for it — but how much you get from it. Here is what you can get from Norton* —

Norton Company gives you the most advanced research engineering and manufacturing facilities in the entire abrasive field — and you get this great scope of detailed knowledge on a personal basis — your Norton Man.

Your Norton Man starts his career by spending a minimum of one year in a carefully planned training course in the Norton plant and a comparable period of training in the field. The Norton Man has an average of 15 years' abrasive experience in addition to the specialized training. He is the most knowledgeable man in abrasives that you can consult. He is your consulting abrasive engineer.

He will make a free Abrasive Requirement Study for you. This study lists the correct specifications for each abrasive job in your plant to assure you lowest cost-per-piece produced. He is also available for complete field testing on specific problems.

For example, your Norton Man can increase production by pointing out ways to better wheel usage and fewer wheel changes. He has the widest selection of grinding wheels in the industry to help him select the perfect wheel for new product grinding operations and improving your current grinding jobs — both at the lowest cost.

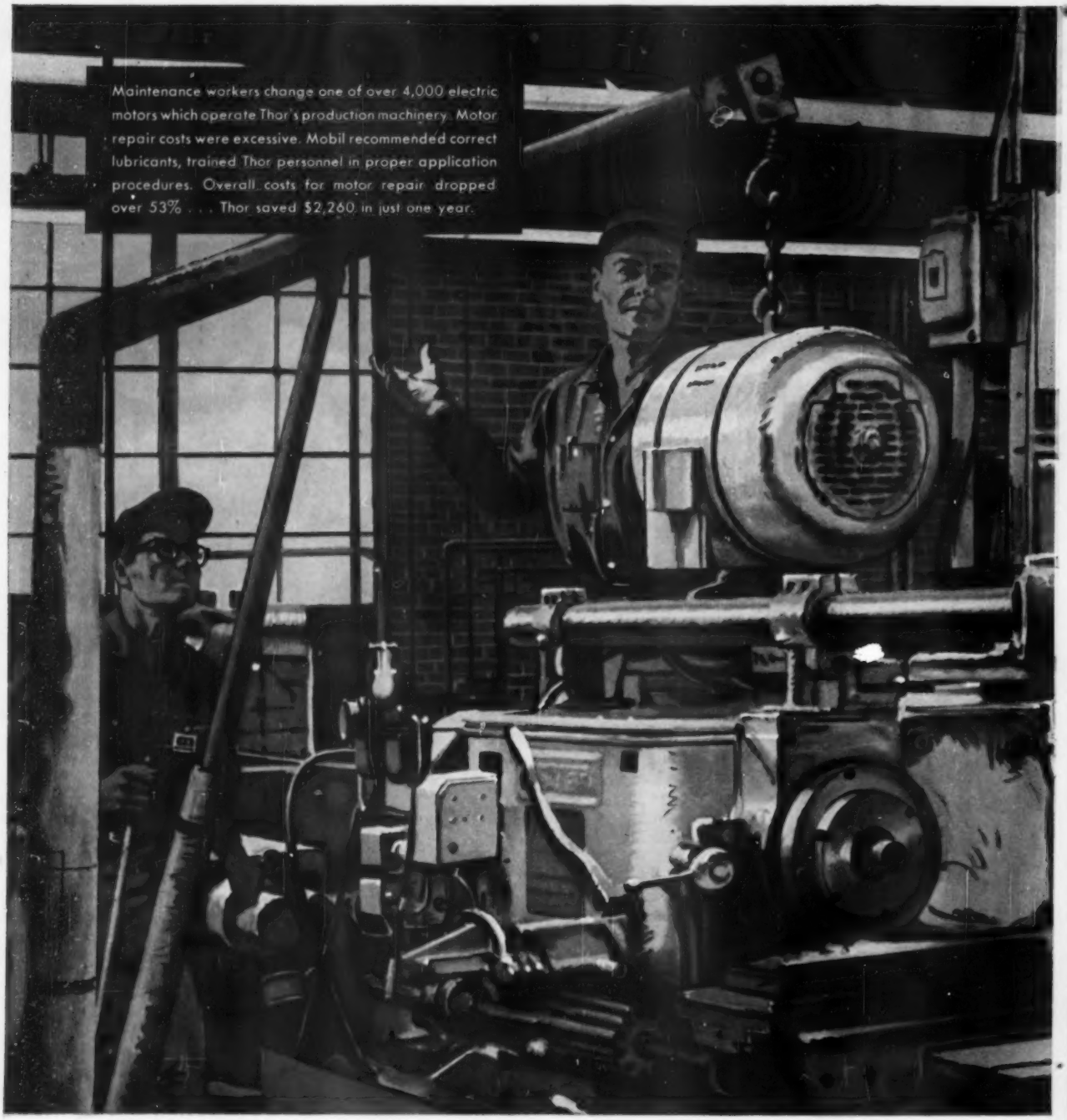
Norton economy pays off in lower cost-per-piece produced. Call your Norton Man. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

W-1973

NORTON
ABRASIVES

75 years of... **Making better products...to make your products better**

Thor relies on Mobil


Maintenance workers change one of over 4,000 electric motors which operate Thor's production machinery. Motor repair costs were excessive. Mobil recommended correct lubricants, trained Thor personnel in proper application procedures. Overall costs for motor repair dropped over 53% . . . Thor saved $2,260 in just one year.

Mobil Correct

Program-saves $15,403!

Thor Power Tool Company boosts production and efficiency, cuts maintenance costs and repair time—with a Mobil Program

Modern production methods and maintenance techniques helped Thor Power Tool become one of the world's largest manufacturers of industrial equipment operated by air, electricity and gasoline. To keep maintenance efficient, Thor relies on a Mobil Program of Correct Lubrication. Mobil has helped Thor in these ways:

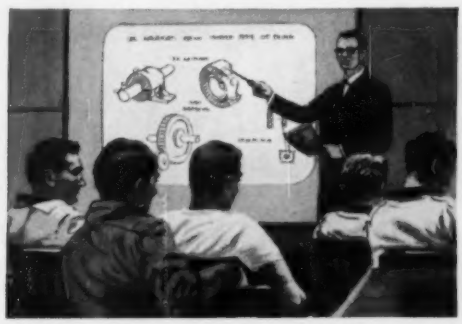
- Establishing exact lubrication recommendations for all plant equipment.
- Training personnel in proper maintenance methods.
- Installing improved application procedures.
- Reducing costly production problems.
- Contributing to Thor product design improvement with regard to lubrication.

As a direct result of the Mobil program, Thor has increased production efficiency . . . cut maintenance costs . . . saved $15,403 in just one year.

For information on how the Mobil Program can help you, call your Mobil representative or write Mobil Oil Co., 150 East 42nd St., N.Y. 17, N.Y.

MOBIL OIL COMPANY
150 East 42nd Street, New York 17, N. Y.

Mobil engineering service contributes to product design improvement. When Thor's Power Trowel developed an annoying lubrication "bug," obstructing featured "finger-tip blade adjustment," Mobil's suggestion and superior grease eliminated problem.



Lubrication clinics conducted by Mobil engineers and a simplified system of product application increased maintenance efficiency materially, permitting reassignment of personnel. Thor saved $4,656 in one year alone.

Slip-stick problems on 3 of Thor's grinders caused downtime and labor loss of four hours a day. Mobil representatives studied the situation . . . recommended a lubricant that solved the problem. Thor saved $1,428 within six months.

On Thor's gear-cutting machines, hobs required frequent sharpening, causing high replacement rate. Mobil recommended cutting oil that prolonged hob life, reduced labor and sharpening costs. Savings to Thor: $7,059 per year.

Lubrication

CALCULATED TO CUT COSTS

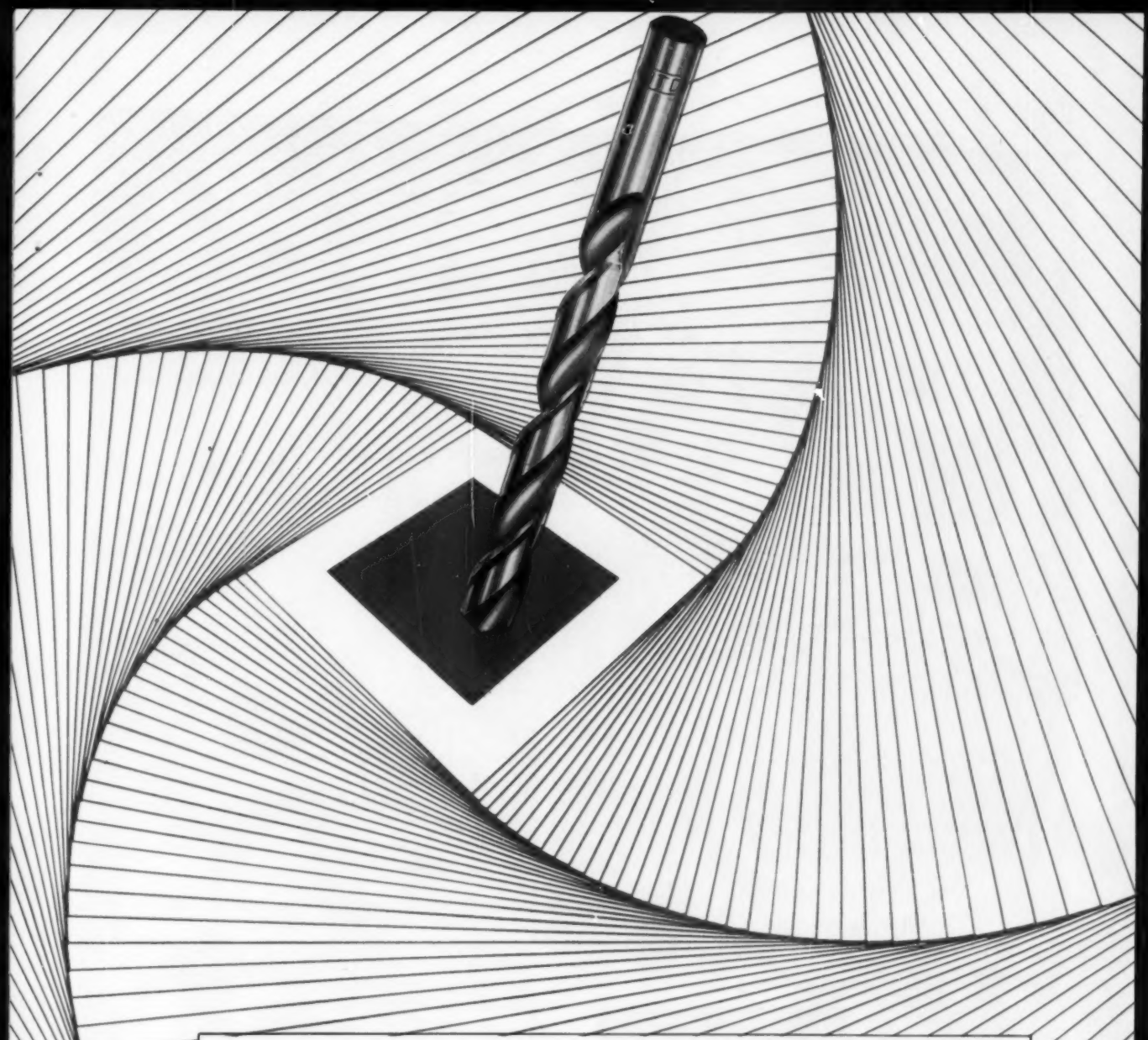
Every CARD tap is an exact geometric duplicate of every other CARD tap of the same size and type. This precise repetition keeps your production consistently high . . . and costs low. Your CARD Distributor can make fast deliveries of the exact types of tap, die, gage, or screw plate you need. Your CARD technical man has complete details on their use. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York and San Francisco.

CARD

DIVISION OF UNION TWIST DRILL COMPANY

Serving you through the best distributors from coast to coast

CIRCLE 209 READER SERVICE CARD



GEOMETRIC PROGRESSION SYMBOLIZES PRECISE DUPLICATION

CALCULATED TO CUT COSTS

Every UNION cutting tool is an exact geometric duplication of every other of the same size and type. This precise duplication of UNION drills assures consistently high production, reduces drill consumption and costly rejects. For best results, specify UNION drills, reamers, milling cutters, end mills, gear cutters, hobs, carbide tools, and inserted blade cutters. Available nationally through UNION Distributors and stocked in UNION warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, San Francisco.

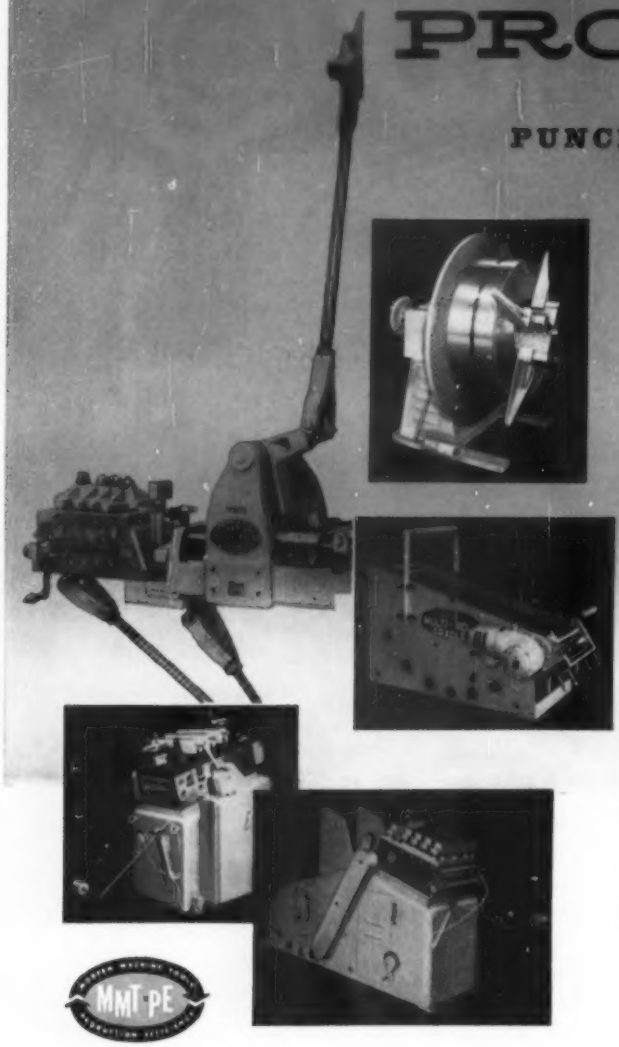
UTD

UNION

UNION TWIST DRILL COMPANY, Athol, Massachusetts

S. W. Card Division, Mansfield, Mass. Butterfield Division, Derby Line, Vt.

CIRCLE 210 READER SERVICE CARD



PROPOSAL

FOR PROFITABLE

PUNCH PRESS PRODUCTION

When the familiar orange and black U. S. Tool Proposal reaches your desk you are on the road to Punch Press Production that will please the most pessimistic.

There is no "high pressure" in a U. S. Proposal. Each one details our method of handling the material for the particular metal stamping project involved. You get the facts . . . you get the figures.

To insure positive Punch Press feeding, major press manufacturers often specify U. S. Feeds and U. S. Stock Straighteners as original equipment. They do so because they know that **Profitable** Punch Press Production depends upon the utmost efficiency, from coil stock to finished stamping.

Consider your present equipment — is it really set-up for **Profitable** Punch Press Production? If not, let us submit our PROPOSAL to help you achieve greater efficiency and economy in your stamping operations.

Send for Bulletins No. 85A and 151A.

Illustrated here are (reading from top to bottom): ACR-1642 U. S. Automatic Centralizing Reel; ACC-1648 U. S. Automatic Coil Cradle; SF-68A U. S. Slide Feed with Plain Straightener; PDS-16H U. S. Power Driven Straightener; PDSC-1648 U. S. Combination Cradle-Straightener.

MMT-PE

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US PRODUCTS

U. S. TOOL COMPANY, INC.

AMPERE (East Orange) N. J.

SPACE 846

MMT-PE

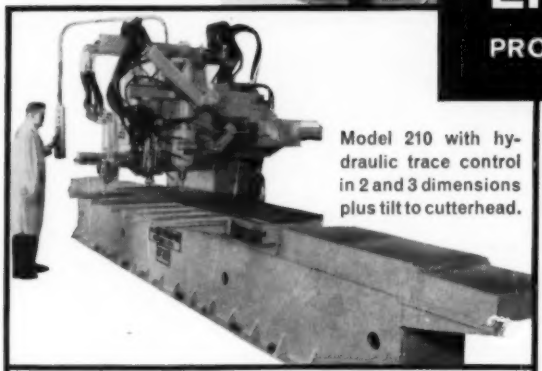
MACHINE TOOL EXPOSITION

The repositionable crossrail makes possible increased work height capacity shown here.

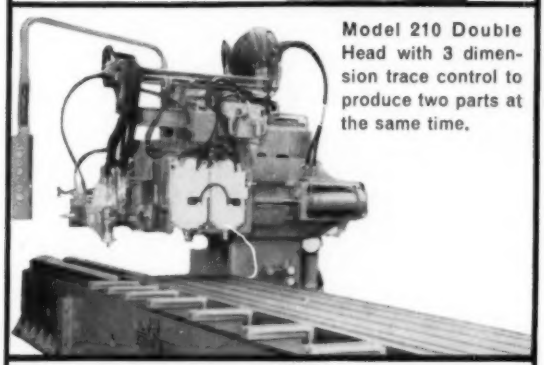
A 42" x 144" Model 210 Ekstrom, Carlson Openside Profiler with 3 dimension trace control.

EKSTROM, CARLSON

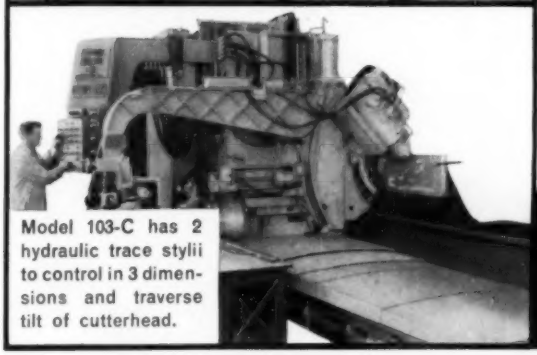
PROFILE AND CONTOUR MILLING MACHINES



Model 210 with hydraulic trace control in 2 and 3 dimensions plus tilt to cutterhead.



Model 210 Double Head with 3 dimension trace control to produce two parts at the same time.



Model 103-C has 2 hydraulic trace stylii to control in 3 dimensions and traverse tilt of cutterhead.

. . . . from small to large

Openside or Bridge Type
Stationary or Traveling Table
Vertical or Horizontal
Single or Multiple Spindles
. . . . with Manual or Automatic Trace and Numerical Tape Control, too!

Yes, whatever your profiling or contouring requirements are there is an EKSTROM, CARLSON Profile Milling Machine (either standard or tailored to suit your special need) that will do your job with utmost efficiency.

Shown here are only a few of our Openside Model 210 Machines and the Model 103-C Traveling Column Horizontal Spindle Machines.

WHY NOT ask for a representative to call and tell you the whole story on these and other EKSTROM, CARLSON high quality Profile Milling Machines.

EKSTROM, CARLSON & CO.
1414 RAILROAD AVE. ROCKFORD, ILL.

▲ CIRCLE 212 READER SERVICE CARD

CIRCLE 213 READER SERVICE CARD ►

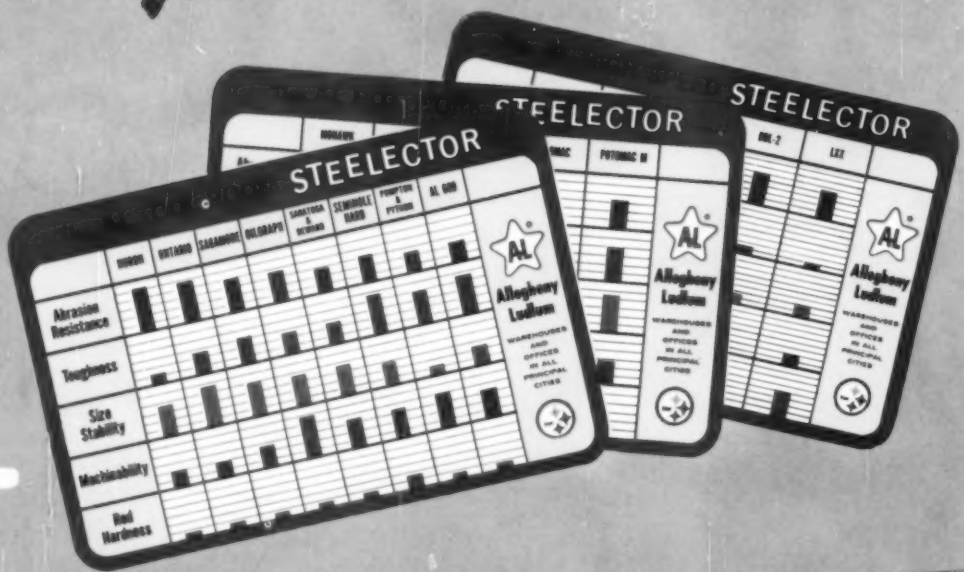
Make a Fast...Easy...Accurate Selection of

and know your size, shape, and grade are

The Allegheny Ludlum
Tool Steel

STEELECTOR

- ✔ every type needed for 96% of all tool steel applications
- ✔ easy selection of the proper tool steel based on its individual characteristics
- ✔ stock shipment of grade and size assured at selection time



the Proper Tool Steel for any Application

Available with the A-L Steelector Program

easy answer to an old problem

Starting right now, the common problem of selecting the right tool steel for any job can become a thing of the past. With A-L's new STEELECTOR Program, you can make a *first time choice* of the proper grade for any application . . . and make it FAST, almost at a glance.

eliminates guesswork

The STEELECTOR is ACCURATE, eliminating guesswork, trial runs, and expensive mistakes. And best of all, the STEELECTOR gives you a choice of tool steels that are AVAILABLE . . . in stock, right now! And they'll *stay* available . . . with a new, increased stocking program. STEELECTOR Grades are stocked according to a study of today's needs and will be reviewed periodically to fit changing requirements.

here's how it works

In the new program, a STEELECTOR Card covering each group of steels (Tool Room, Hot Work, and High Speed Grades) will help you select one particular grade as the best for your application. The STEELECTOR presents five basic tool steel properties—Abrasion Resistance—Toughness—Size Stability—Machinability—Red Hardness—as bar graphs, with the length of the bar showing the extent of each property in every STEELECTOR Grade. Find the properties most important to you and, by inspection, pick the grade with the characteristics you need.

availability assured

There is a separate Data Stock List for each STEELECTOR Grade, showing its complete range of warehouse stocks, as well as technical

data and basic application information. So, you can be sure the grade, size, and shape of your choice is in stock.

quality assured

And you can count on Allegheny Ludlum quality in every STEELECTOR Grade. They are selected from the complete line of A-L Tool Steel and made under the rigid quality control standards of all A-L products.

details available

It's all explained in the colorful A-L Tool Steel STEELECTOR Booklet, which includes STEELECTORS for the Tool Room Grades, Hot Work Grades, and High Speed Grades, and explains the Data Stock Lists for every STEELECTOR Grade. Ask your Allegheny Ludlum Sales Representative for your copy, or write: Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa. Address Dept. Ins. 7.

STEELECTOR PROGRAM

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country

Fine tools that encourage Good Work

ARMSTRONG WRENCHES

SEE US AT
BOOTH 238
PRODUCTION ENGINEERING
SHOW
SEPTEMBER 6-16
NAVY PIER
CHICAGO, ILLINOIS

INDUSTRIAL DISTRIBUTORS
SERVING INDUSTRY ECONOMICALLY
THE RIGHT HAND OF PRODUCTION

If you don't know your local ARMSTRONG Distributor, we will send you the names of those in your area.

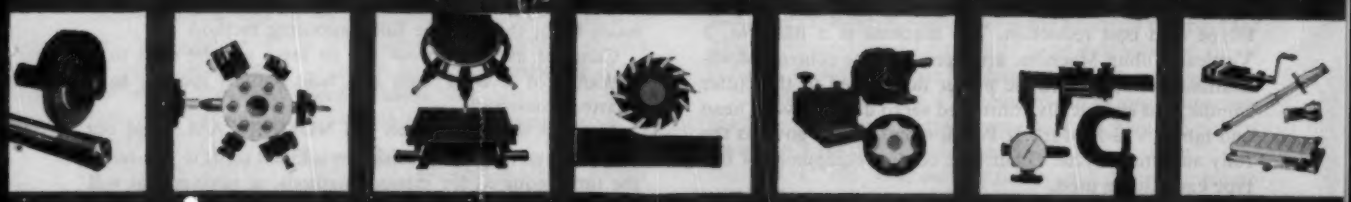
An ARMSTRONG Wrench feels right—is balanced. It goes over nuts or screw heads easily, grips firmly without sloppiness, won't round corners—because openings are carefully machined to correct sizes. It's safe, strong beyond need without clumsy bulk—because of superior design and selected steels, heat treated to proper degree of hardness and tensile strength. It's quality finished, ARMALOY (alloy steel) Wrenches in chrome plate with heads buffed; HI-TEN (carbon steel) Wrenches in baked-on gray enamel with heads ground bright . . . all plainly marked for size. All are uniformly excellent tools manufactured under strict quality control, by modern methods, with modern equipment in a modern tool plant . . . 1537 different industrial sizes and types—single wrenches, or sets in metal cases, boxes or rolls . . . each a quality tool. Armstrong Wrenches are "Fine tools that encourage good work."

ARMSTRONG BROS. TOOL CO. 5215 W. ARMSTRONG AVE. • CHICAGO 46, U.S.A.

◄ CIRCLE 214 READER SERVICE CARD

CIRCLE 215 READER SERVICE CARD ▲

to help you make more for less...



Brown & Sharpe

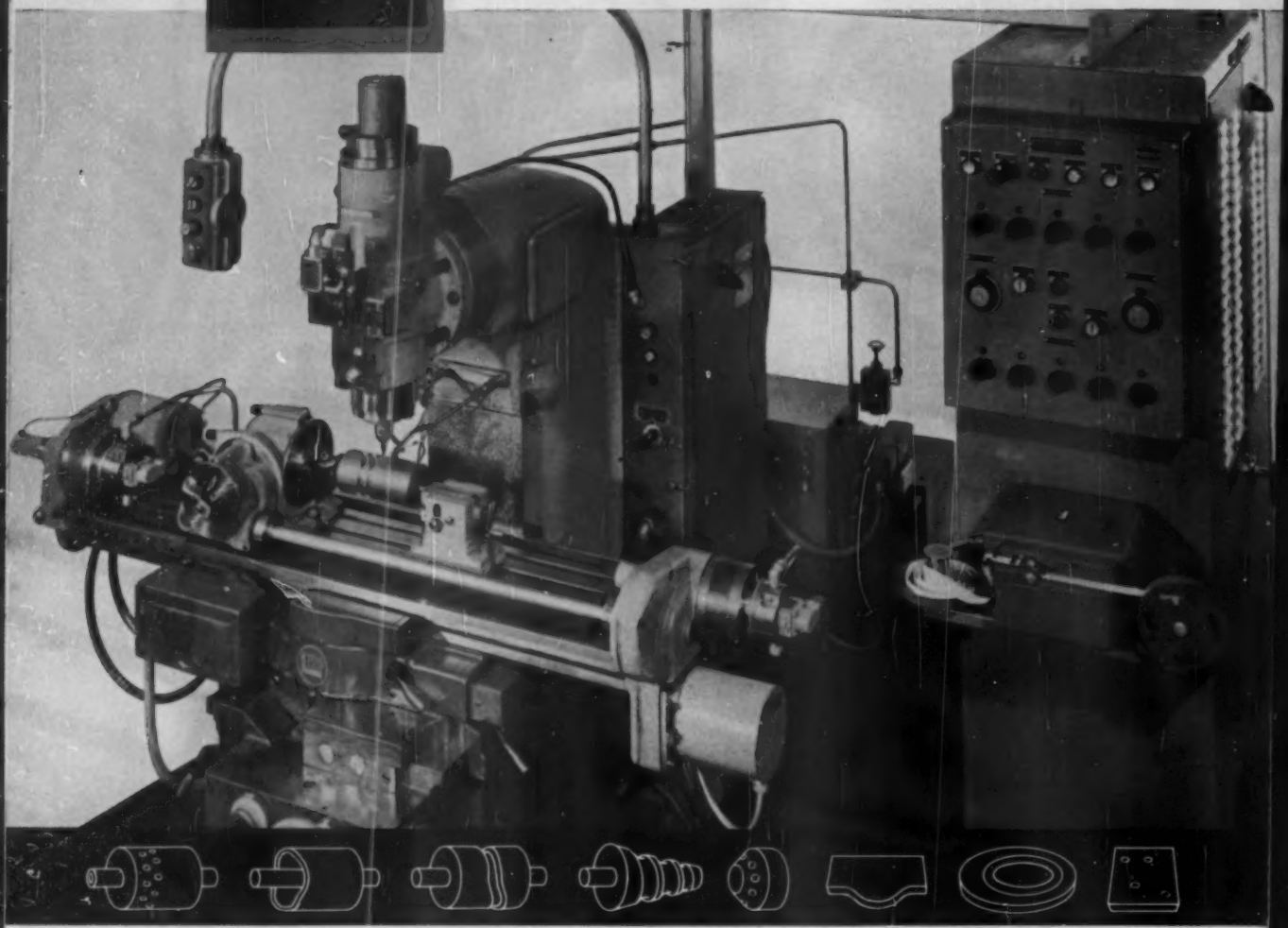
PRECISION CENTER

MACHINE TOOL
EXHIBITION
BOOTH 407

MMT-PE

Booth 452
Machine Tool
Exposition

TO HELP YOU MILL MORE FOR LESS



The **NUMERICAM** can be readily programmed for milling any type of cam path or hole pattern — in cylindrical, conical, or flat surfaces; on plate cams or templates.

Small research-type computers are used for data calculation, and the tape is standard 8-channel type. Tape for simple hole patterns can be produced on the Flexowriter.

New Brown & Sharpe tape-controlled NUMERICAM saves up to 90% of cam layout and machining costs

The NUMERICAM is a revolutionary new system for prototype cam cost reduction. The machine is a B&S No. 2 Vertical Milling Machine, arranged for tape control. Modifications include hydraulic power down feed to the cutter spindle, and electrically controlled servo drive to work head and table. A G-E Mark II Positioning Control governs the fully automatic cycle. Other tape control equipment of this type can also be used.

The computing and control equipment used is relatively simple, because the NUMERICAM is designed for point-to-point cam-path machining. The investment required is much lower than for the full contouring method.

Cams of average throw (6" or less) can be held to a tolerance of ±.0002 inch and hole pattern spacing to a quarter-thousandth.

Get full information on the NUMERICAM. Find out how you can turn out precision machined cams in one-tenth the time required for manual methods, at savings that will write off the investment in record time. Write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, R. I.

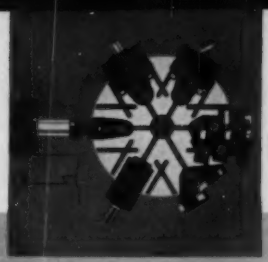
Brown & Sharpe PRECISION CENTER

◄ CIRCLE 216 READER SERVICE CARD

▲ CIRCLE 217 READER SERVICE CARD

MMT-PE

Booth 452
Machine Tool
Exposition



TO HELP YOU REDUCE SCREW MACHINE PRODUCTION COSTS

B&S No. 4 . . . the big Automatic for big savings on long or short run jobs in the 2" range

The Brown & Sharpe No. 4 Automatic Screw Machine is the profitable partner in productivity to the B&S No. 00 and No. 2 Automatics. It turns out the larger work with equal efficiency, precision, and fine finish. You can keep it busy day after day, and it pays off on moderate volume work as well as big production.

Easy accessibility of the turret face speeds set-up, avoids fatigue caused by difficult "reaching." The operator can stand 20 inches closer when adjusting tools than he can with comparable machines. Because set-up is so much easier and faster, the No. 4 Automatic is the practical machine for shops now producing a variety of parts in job lots on turret lathes or multiple-spindle machines, at high hourly rates.

Find out how the No. 4 Automatic can fit into your screw machine production requirements, and pay you the highest return on your dollar investment. Takes stock up to 2" dia. (up to 2⅜" dia. with outside feed), and turns any length up to 5". Spindle speeds, 1965 to 17 rpm, provide range suitable for any machinable material. Write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, R. I.

Brown & Sharpe PRECISION CENTER

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MMT-PE

Booth 452
Machine Tool
Exposition

TO HELP YOU GRIND MORE FOR LESS

Designed by cutter specialists for extra savings - B&S No. 10N and No. 5 Cutter and Tool Grinding Machines

Brown & Sharpe Cutter and Tool Grinding Machines provide the advanced features today's toolrooms need to handle more kinds of sharpening jobs, to turn out more work per day, and to maintain consistent high precision.

Many of these design advantages are available only in B&S Tool Grinders, for logical reasons. Brown & Sharpe is a leading producer of milling cutters. B&S cutter specialists collaborate on design of the machines. The No. 10N and the No. 5 are the results — two machines that set the standard for top economy in tool maintenance.

Brown & Sharpe design provides *precision glide* roller-bearing table movement — wheel mounting at *both ends* of the spindle — cutter bar attachment that *eliminates* critical table setting on peripheral sharpening. Both machines are 100% operative from any point in 360° work area.

The No. 10N (left), capacity 10" x 29", will handle all your sharpening jobs. With optional universal equipment, it can also be used for light external and internal cylindrical grinding and surface grinding. No. 5 has ample capacity, 6⅜" x 17½", for routine sharpening — takes less than 8 sq. ft. of floor space. Standard work head tapers fit all commonly used collets and adapters.

For full information, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Brown & Sharpe PRECISION CENTER

CIRCLE 219 READER SERVICE CARD

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Booth 452
Machine Tool
Exposition

TO HELP YOU MAKE PRECISION MEASUREMENTS EASIER AND FASTER . . .

In your lab or on your production line — 3 ways to assure Brown & Sharpe precision

1 B&S Hite-Set® with new 4" Super-Speed head, sets any height in its range, quickly, with gage-block accuracy. Micrometer head is the biggest in the industry. It actuates a series of .5000" blocks, accurate overall to 50 millionths, from which measurements are taken — spreads ten-thousandth divisions out so they can be easily read at arm's length. Hite-Icator®, also available, is the same tool with a reference dial added to indicate thousandths. Both tools are available with 1" to 10" or 1" to 20" range. They are the *most economical* tools of this type, based on price per inch.

2 B&S Johansson® and Thrift® Gage Blocks are the foremost measurement standards in industry. These hand-lapped "gems of precision" are available in AA, A, B and Thrift classes of millionths accuracy — to suit every gage block need at minimum cost.

3 B&S Sine Plates and magnetic-top Perma-Sines, set to gage blocks, establish the most precise angles you can get for inspection and machining. They are accurate overall to 2 ten-thousandths — beautifully hardened, finished and fitted, yet reasonably priced. Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

INDUSTRIAL DISTRIBUTORS — THE RIGHT HAND OF PRODUCTION

Brown & Sharpe PRECISION CENTER

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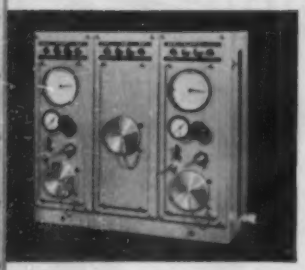
How many of these products



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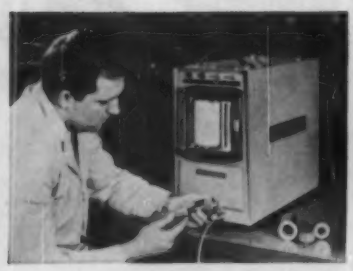

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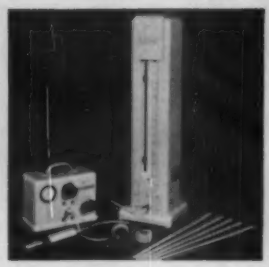

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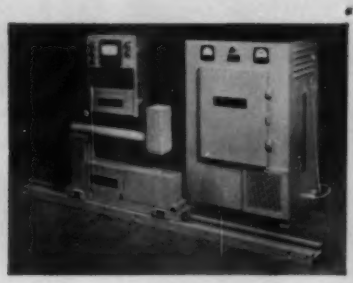

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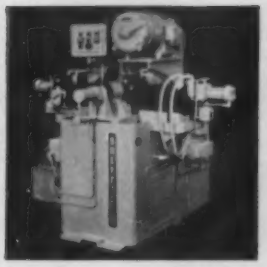

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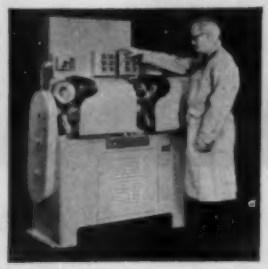
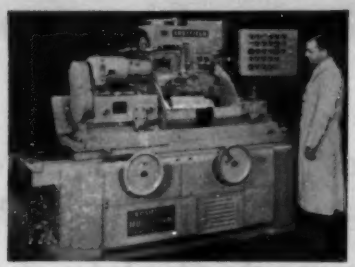


18

1. Pneumatic gage control unit
2. Pneumatic Recorder
3. Precisionaire® gages
4. Measuray® thickness gage
5. Crankshaft gage
6. Multiform grinder
7. Machine control unit
8. Thread rolling machine
9. Double end precision threading machine
10. Automatic piston pin gage
11. Plunjet airsnap
12. Thread and form grinder
13. Automatic bearing assembly machine
14. Airetest® indicator
15. Press-Pacer® transfer machine
16. Monitorecord® machine operations analyzer
17. Master setting rings, xxx and xxxx
18. Gear chamfering machine
19. Micro-Form grinder
20. Plunjet® gaging cartridges
21. Cavitron® ultrasonic metal working machine

can you identify?

5



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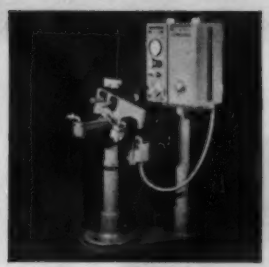

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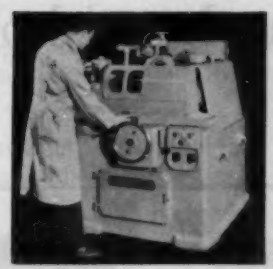

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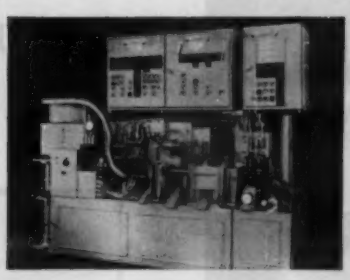

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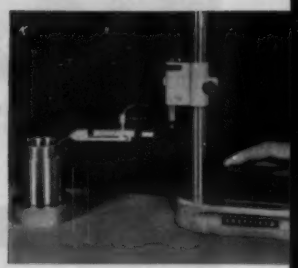

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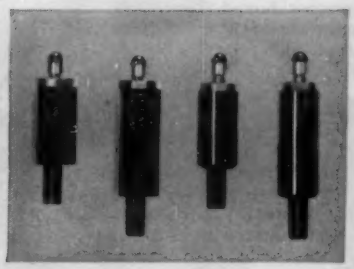

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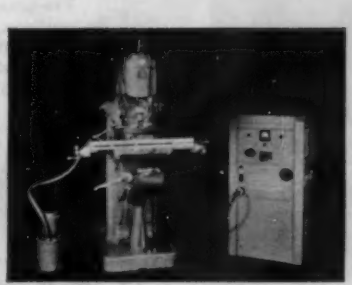


21

Here are just a few of the many precision products Sheffield makes. You'll do well to identify as many as six of those shown. May we send you a copy of Catalog No. GC957 showing more of Sheffield's complete product line?

Or for specific information, just circle the number, clip the ad and mail. We'll send the appropriate catalogs.

The
SHEFFIELD
Corporation *Dayton 1, Ohio*

A subsidiary of The Bendix Corporation

Gages, Measuring Instruments, Automatic Gaging & Assembly Systems • Machine Tools • Contract Mfg.

Metallurgical Memo from General Electric

GENERAL ELECTRIC ANNOUNCES PRE-HONED

Hand-honing is inaccurate, time-consuming—often results in premature chipping and breaking.

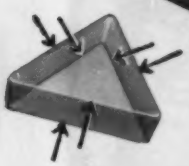
Chamfered, or ground-flat, edges are geometrically weaker than a radius and are more easily chipped or broken.

Unhoned or as-ground inserts show rough edges—result in unpredictable tool life due to chipping.

Now you get more predictable tool life... lower cost per cutting edge ...no hand-honing cost!

Pre-honed inserts with uniform, precise honed edges offer top strength; improve tool life predictability.

Additional savings result through the elimination of costly and often inaccurate hand-honing methods.



Because chipping and breaking are minimized, pre-honed Carboloy inserts result in lower average cost per cutting edge.

TOPS IN TOOLING QUALITY

From the research and quality-control facilities of the Metallurgical Products Department of General Electric comes the outstanding quality tooling line in the metalworking industry. The new Carboloy pre-honed inserts, as well as the complete line of Carboloy toolholders, inserts, insert seats, convertible seats, and brazed tooling, are designed to meet every tooling need efficiently and economically.

CARBOLOY® INSERTS

Delivered ready-to-use . . . honed to a precise radius . . . promise BETTER PROFITS THROUGH BETTER TOOLING

Now General Electric Carboloy inserts are pre-honed *at the factory!* Here's what it means to you:

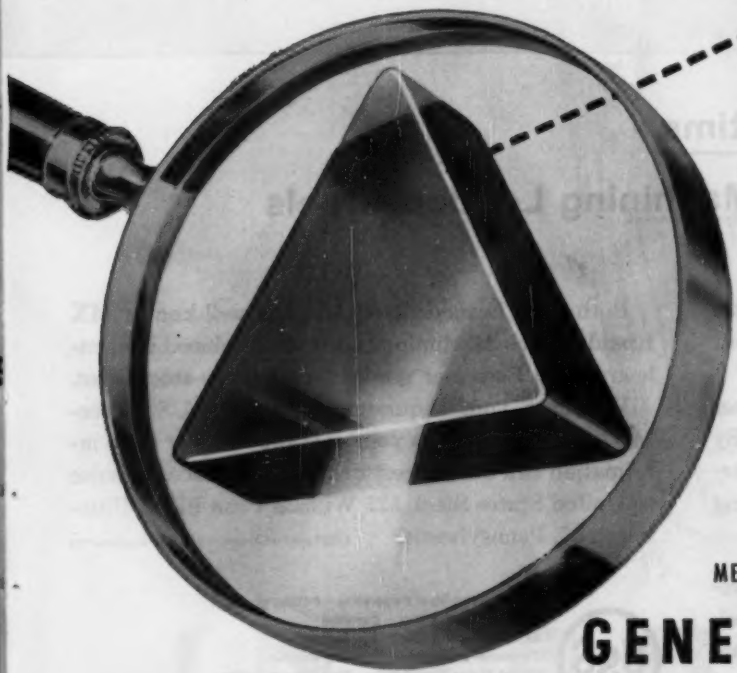
1. An insert with edges honed to precise *radii* gives the strongest geometric shape to withstand cutting pressures. This reduces the chance of chipping—increases the predictability of tool life. Hand honing *cannot* achieve precise radii—G-E pre-honing can . . . and does!

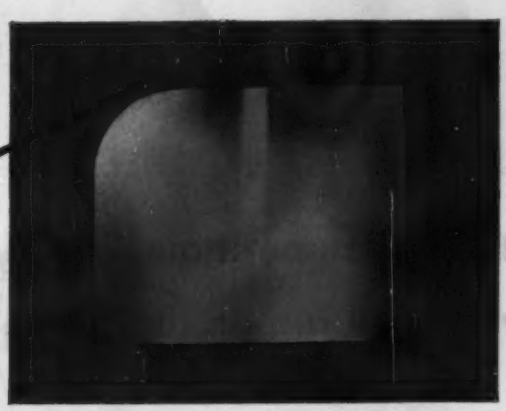
2. Since chipping is minimized, fewer cutting edges are wasted. The result is lower cost per cutting edge.

3. Since inserts come pre-honed and ready-to-use, the labor cost and inaccuracies of hand honing are eliminated. This more than offsets the additional charge for pre-honing.

4. Pre-honed Carboloy cemented carbide inserts have standard edge radii honed to a greater or lesser degree, depending on the job to be done. You'll *know* the honing is right!

Ask your Authorized Carboloy Distributor about pre-honed Carboloy inserts, convertible seats, toolholders, and brazed tools. Or, write directly to: *Metallurgical Products Department of General Electric Company, 11149 E. 8 Mile Road, Detroit 32, Michigan.*





Shown here, both under magnification and graphically, is an edge of the new Carboloy pre-honed insert. Radius is geometrically ideal to minimize chipping, extend tool life many times.

CARBOLOY
CEMENTED CARBIDES

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

CARBOLOY® CEMENTED CARBIDES • MAN-MADE DIAMONDS • MAGNETIC MATERIALS • THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS

This mark tells you a product is made of modern, dependable Steel.

More parts per hour—every time when you run on USS Free-Machining Leaded Steels

You can *consistently* count on greater output, better finish, longer tool life and lower costs, when you put USS Free-Machining Leaded Steels to work.

By increasing the rate of production, USS Free-Machining Leaded Steels lower the cost per part. By prolonging tool life, they reduce downtime. By assuring better part finish, they eliminate extra finishing operations.

Why USS Free-Machining Steels offer more. Good steelmaking practices are the rule at United States Steel. Close control of chemical balance, rolling and finishing practices, and high inspection standards are combined to produce a bar stock of *consistent* high quality.

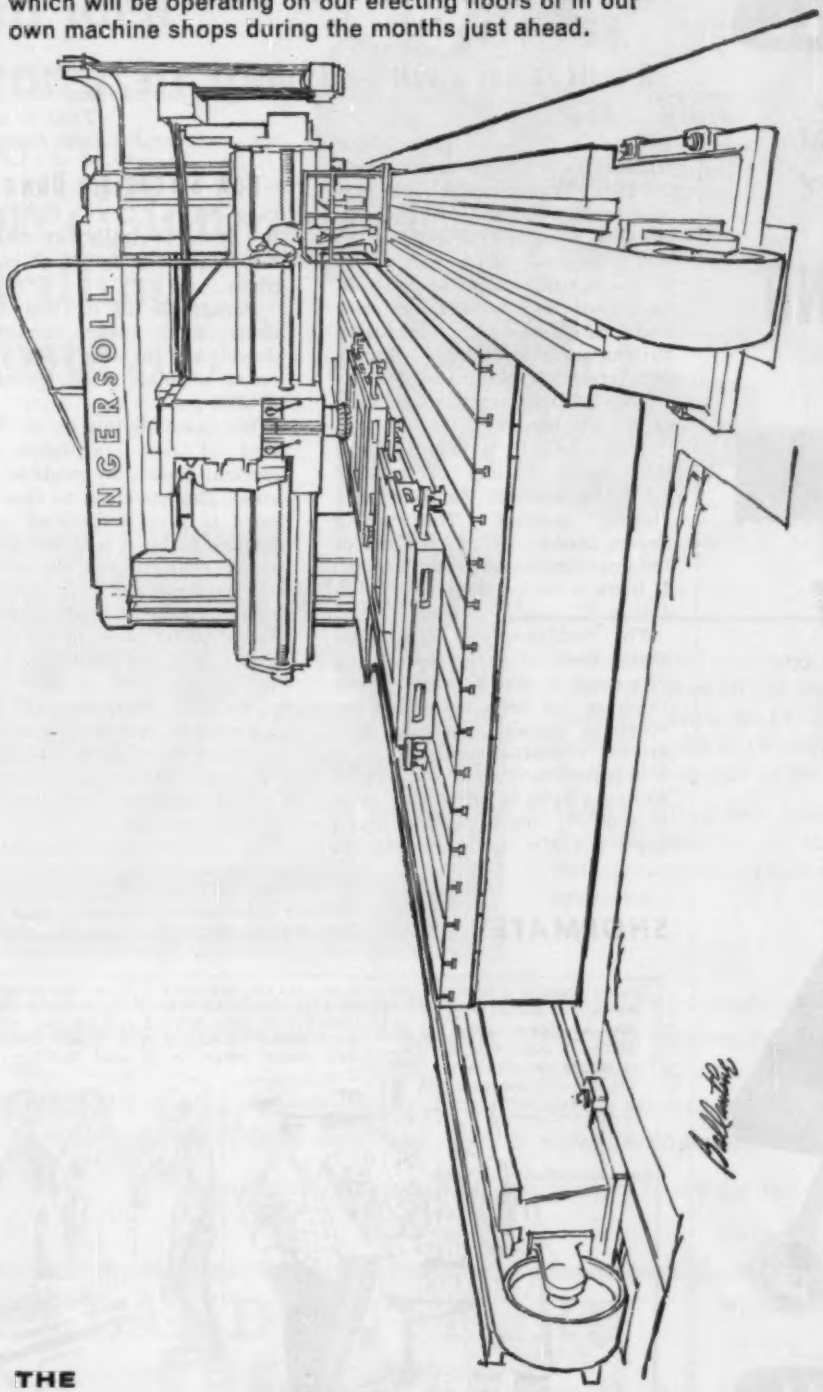
Both USS Leaded Steels and the well-known MX Brand of Free-Machining Steels are produced in open-hearth and Bessemer grades, in all screw-stock sizes.

Whatever your requirements, specify USS Free-Machining Steels from your cold drawer. For more information call our nearest district sales office, or write to United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania. *USS and MX are registered trademarks*

United States Steel Corporation—Pittsburgh
American Steel & Wire—Cleveland
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company
United States Steel

NEW AT INGERSOLL....

This is one of a number of
NEW INGERSOLL MACHINES
which will be operating on our erecting floors or in our own machine shops during the months just ahead.



A NEW 17-FT. GANTRY-TYPE ADJUSTABLE RAIL MILLING MACHINE: Using carbide tools to mill steel weldments up to 17 ft. wide, 6 ft. high, and 40 ft. long, this 220-ton machine, with a single 100 hp. milling head, will replace five planers. It is designed as a gantry-type machine to conserve shop space. The completion and testing of this machine will be of special interest to late summer visitors at Ingersoll.

THE
INGERSOLL
MILLING MACHINE COMPANY
ROCKFORD, ILLINOIS

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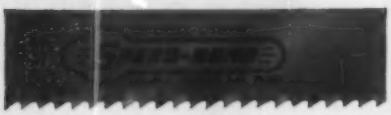
CAPEWELL

is the originator and developer of the revolutionary new L-100-M

SPEED-BAND®

double carbide Band Saws



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CAPEWELL

THE CAPEWELL MFG. CO.
HARTFORD 2, CONN.

LETTERS

to the editors

330 W 42nd St, New York 36, NY

A helix is not a spiral

Dear Sirs:

Helix or spiral—why not use the right name? I have been trying for about 70 years, with little success, to have engineers distinguish between a helix and a spiral.

A little progress has been made in the designation of small tools such as milling cutters, reamers, and taps. However, confusion still exists, even in the columns of AMERICAN MACHINIST/METALWORKING MANUFACTURING, in spite of its new name.

The excellent article, "Spiral mill welds variety of tubing" (*AM/MM*—Mar 21 '60, p114) is a glaring example. The tubing shown cannot, by any stretch of the imagination, be called a spiral. If there is such a thing as a helix, this is it.

The best example of a spiral that I know of is the mainspring of a clock or watch. Possibly our thinking has been influenced too much by certain staircases built around a central column.

It is possible that we will go on calling a helix a spiral long after it is of any interest to me. But I hope *AM/MM* will not get the habit of using the term so incorrectly as in the case mentioned.

Fred H Colvin
Point Pleasant Beach, NJ

How Strong are Dowels?

Dear Sirs:

Re: "How to Apply Fasteners" by J R Paquin (*AM/MM*—Mar 7 '60, p106).

Paragraph 15 of this article deals with shear strength of dowels and includes a table based on an ultimate shear strength of 190,000 psi.

We question this value. To the best of our knowledge, commercial dowels are made of C1117 steel. This steel can be case hardened to give a specified surface hardness, but it will not give the shear strength you are referring to. We have had experience with dowels used as shafts, and they failed under shear loads that we estimate being far under 190,000 psi.

We doubt that any of the higher alloys such as 4140 or 8650 would measure this high in shear, except in high hardness ranges that would make the pins too brittle for normal use.

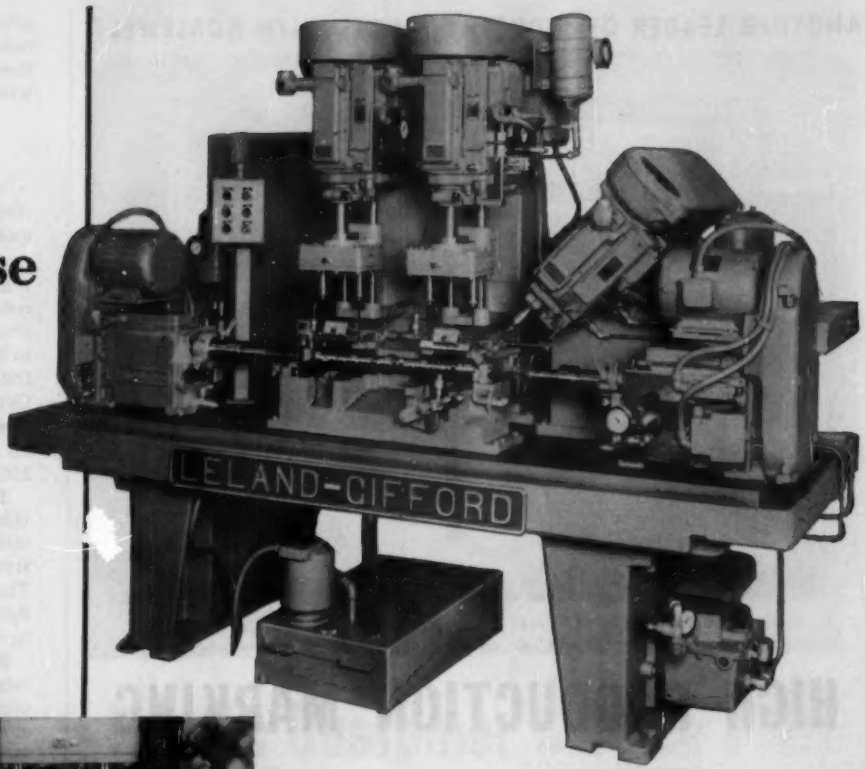
If we are misinterpreting this

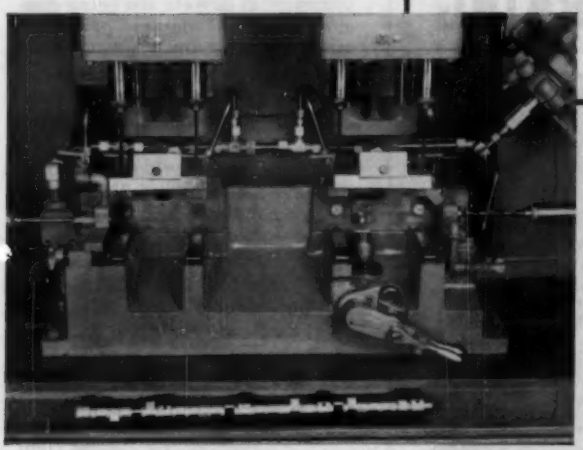
SHOPMATES

N. Jarvis

I WAS GIVIN' IT A FINAL POLISH··· IT GOT A LITTLE DRY SO I ADDED WATER AND··· IT JUST FELL ALL TO PIECES ··· MUST'A BEEN TOO HOT ··· IT SHATTERED!
A MILLING MACHINE AIN'T NO PLACE TO POLISH GLASS LENSES ··· IT JUST AIN'T RESPECTABLE ··· A MILL IS FER HOGGIN' METAL !!
··· HE WAS GIVIN' US THE BUSINESS ABOUT HOW HE'S THE ONLY ONE OF US SMART ENOUGH TO WORK GLASS ···
N. JARVIS

Here's an idea you can use to cut precision drilling costs....





One machine, one handling, one quick, simple operation does all the precision drilling on this camshaft. Note that this is not ordinary gang drilling — the job involves axial, angular and cross holes as well as reaming.

Leland-Gifford has time-saving, cost-cutting ideas for you, too — ways you can combine multiple operations into a simple, efficient unit operation.

THE JOB: Drill one end of camshaft and ream the other while drilling four cross holes and one angular oil hole.

THE MACHINE: A Leland-Gifford special with five No. 2 self-contained units and standard hydraulically clamped fixture interlocked with drilling units to start feed after clamping and to unclamp when operation is finished. SC units are interlocked to prevent interference between cross and axial drills. One operator completes 60 camshafts per hour at 100% efficiency.

For Automatic Drilling at its best be sure to see Leland-Gifford

CALL THE OFFICE NEAR YOU

LELAND-GIFFORD SPECIAL DRILLING MACHINES

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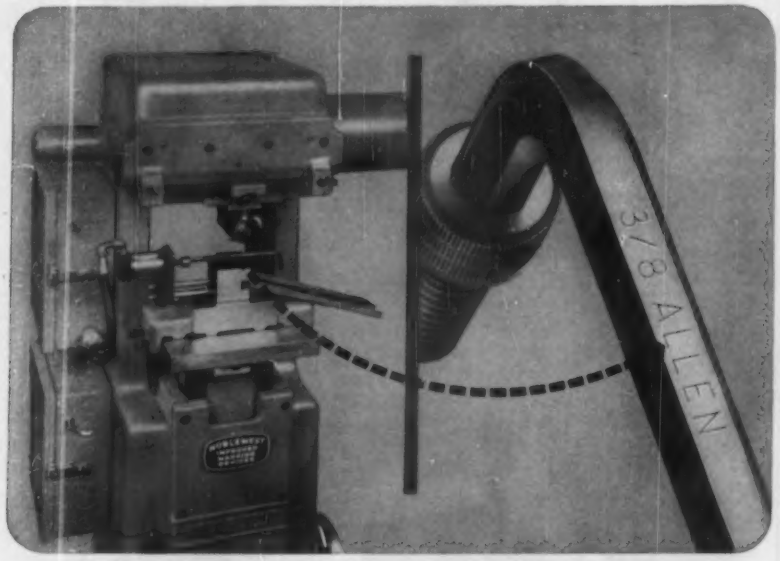
Rochester 12, P. O. Box 24, Charlotte Station

ANOTHER LEADER OF INDUSTRY MARKS WITH NOBLEWEST



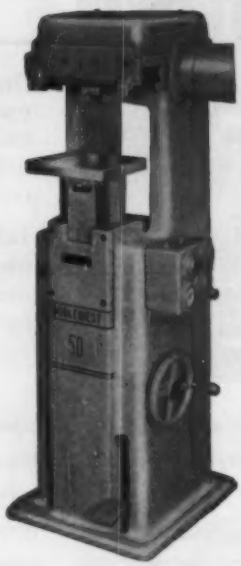
Model 50P1—395 Roll Marks manufacturer's name and size identification permanently into all sizes of Allen Head hex wrenches.

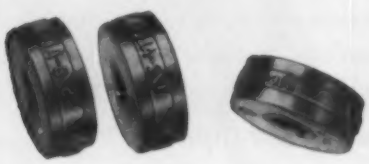
HIGH PRODUCTION MARKING

WITH NEW

Cyclomatic Control

This general purpose marking machine combines the original NOBLEWEST Roll Marking process with CYCLOMATIC CONTROL . . . an exclusive NOBLEWEST electro-pneumatic circuit for completely automatic cycling. When set for automatic operation the machine cycles continuously with no further attention required from the operator. A dual control system also provides for semi-automatic operation or for short production runs. This model can also be equipped with an air ejection system (see above) plus an automatic hopper or dial feed. The basic Model 50P1 features a low price, plus quick delivery! For complete information on how NOBLEWEST Marking Machines, tools and dies can lower your production costs, write for new catalog. The Noble & Westbrook Manufacturing Company, 17 Westbrook Street, East Hartford 8, Conn.





At left are Noblewest Precision Roll Marking Dies used for marking Allen wrenches. Inscription is duplicated three times on each die, thus tripling the die life.

A few desirable territories open to qualified representatives

MARK IT BEST WITH NOBLEWEST IMPROVED MARKING DEVICES

NOBLEWEST

ORIGINATORS OF THE ROLL MARKING PROCESS

MARKING
NUMBERING
EMBOSSING
GRADUATING

article, or if there are dowels obtainable that are as strong as those referred to by Mr Paquin, will you please tell us?

H R Hilstrom, *president*
Driv-Lok Machine Corp
Sycamore, Ill

Here is Mr Paquin's answer to the question:

I am suprised to learn that you consider the value of 190,000 psi single shear strength for dowels to be excessive. It was taken from the Allen Manufacturing Co's General Catalog G-51, p16. Shear strengths of their dowels are given as ranging from 190,000 to 210,000 psi.

The Allen Manufacturing Co, Hartford, Conn, has a fine reputation, and I know it has extensive laboratory test facilities. Therefore, I have accepted Allen's figures as the most accurate ones to which I have access.

However, your letter has certainly emphasized that when *all* commercial dowels are being considered, two classes of shear strength may be recognized. Also, that dowels may be made from alloy steel or from cold drawn steel, case hardened, and that safe shear strengths of each will vary considerably.

I have made appropriate memos on this point as guides in developing future tool-design articles. Perhaps the best solution would be a table for alloy steel dowels and one for cold drawn steel dowels. I think we can agree that, for dies, alloy dowels should be employed because of the loads and shock conditions encountered.

J R Paquin, *supervisor*
Tool & Die Design Dept
Cleveland Engineering Institute

"Trucker!"

CALENDAR

National Association of Metal Finishers—Annual Convention, July 22-24, Statler Hilton Hotel, Los Angeles, Calif.

American Machine Tool Distributors Association—Annual Meeting, Sept 3-4, La Salle Hotel, Chicago, Ill.

National Machine Tool Builders Association—Machine Tool Exposition, Sept 6-16, International Amphitheatre, Chicago, Ill.

Production Engineering Show, Sept 6-16, Navy Pier, Chicago, Ill.

Coliseum Machinery Show, Sept 7-15, Chicago Coliseum, Chicago, Ill.

Society of Automotive Engineers—Farm, Construction, and Industrial Machinery Meeting, Sept 12-15, Milwaukee Auditorium, Milwaukee, Wis.

American Die Casting Institute—Annual Meeting, Sept 14-15, Edgewater Beach Hotel, Chicago, Ill.

American Welding Society—National Fall Meeting, Sept 26-30, Penn Sheraton Hotel, Pittsburgh, Pa.

Instrument Society of America—Instrument-Automation Conference & Exhibit, Sept 26-30, Coliseum, New York, NY

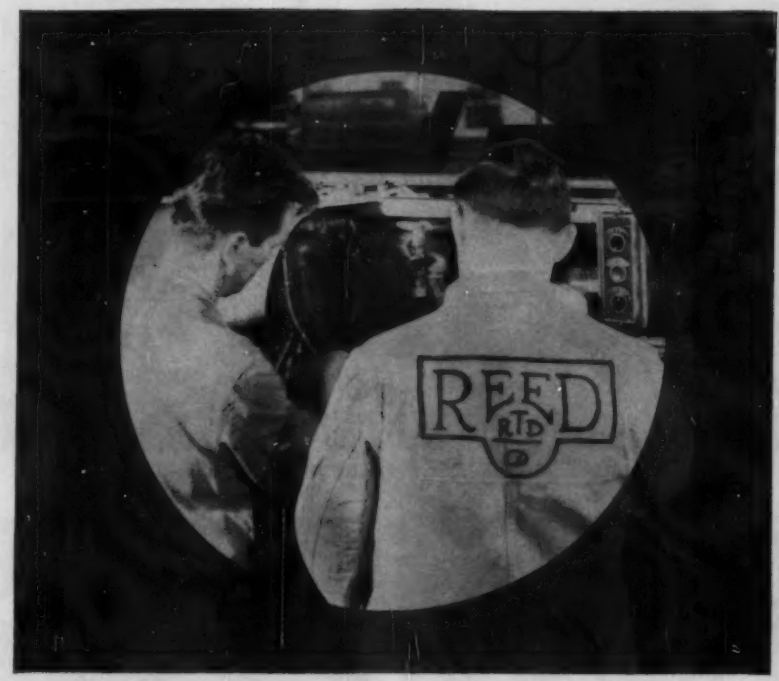
Pressed Metal Institute—Annual Meeting, Oct 10-14, Shawnee Inn, Shawnee on Delaware, Pa.

Society of Automotive Engineers—National Aeronautic Meeting and Display, Oct 10-14, The Ambassador, Los Angeles, Calif.

Industrial Management Society—Industrial Engineering and Management Clinic, Oct 13-14, Conrad Hilton Hotel, Chicago, Ill.

National Safety Council—National Safety Congress, Oct 17-21, Conrad Hilton Hotel, Chicago, Ill.

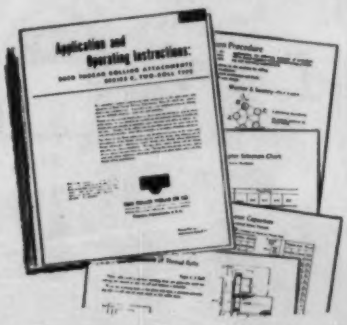
American Society for Metals—National Metal Exposition and Congress, Oct 17-21, Trade and Convention Center, Philadelphia, Penna.



Reed's Customer Service Plan

guarantees top thread rolling performance of your Reed Attachment

Highly skilled Reed personnel assist with initial installation and give a thorough training on the use and operation of the attachment. This personal service assures complete satisfaction in the operation of your Reed Attachment.



Complete technical information is furnished in the application and operating instructions booklet. With this booklet setup men without previous thread rolling experience have successfully completed setup for production.

Write for your copy of Thread Rolling Attachment Bulletin B-2 for helpful information on Thread and Form Rolling

REED RTD TRA-169

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

HOLDEN, MASSACHUSETTS, U. S. A.

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NEW TOOL STEEL SERVICE

reduces heat treating costs

The man who heat treats many different tools

can realize major savings with Crucible's new Tool Steel Service.

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he'll now be able to heat treat many more tools at one time.

He'll know exactly how each grade responds to heat treating.

—so he'll certainly get more consistent results by employing time-tested techniques.

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CRUCIBLE STEEL OF CANADA, LTD., SOREL, QUEBEC, CANADA

Here's a Hot Number

On "Acorn" Dies truly concentric adjustment demands lands with uniform "give".

Spring tempering by precision induction heating (controlled time and temperature) is one more manufacturing refinement that helps make *genuine* "Acorns" the HOTTEST BUY in spring type dies.

"ACORN" means GREENFIELD — GREENFIELD means QUALITY

GREENFIELD TAP & DIE

GREENFIELD, MASSACHUSETTS

Without SCREW THREADS not one of these products for modern living would be possible. And, only *taps* generate internal screw threads with the speed and precision demanded by modern production methods.

But, today your precision tapping jobs cannot be entrusted to *just any tap.* Your taps must be backed by precision engineering, precision measuring tools and time earned know-how. There is a big difference in using *just any taps* and using TAPS by GREENFIELD.

GREENFIELD TAP & DIE

GREENFIELD, MASSACHUSETTS

SPOT NEWS...

- **Fundamental research into why metal wears** is under way at Armour Research Foundation. Experimental machines will force metal to wear, and the extent of wear will be measured through weight loss, dimensional changes, and surface damage. Sponsors are American Steel Foundries, Bethlehem Steel, Briggs and Stratton, Clevite, Dow Chemical, Inland Steel, International Harvester, International Nickel, Socony-Mobil, and U S Steel.

- **Heating and die-forging should be conducted under argon** to prevent formation of scale, according to an article in a recent Russian metalworking publication. Though no reference is made to the material being worked, it appears to be alloy steel. Universal-Cyclops Steel Corp is die forging refractory metals under argon at its InFab facility (*AM/MM*—Jun 13 '60, p120), but this seems too expensive a technique for steel.

- **Vacuum arc-melting plus ultrasonic grain refining adds up to better steel** for Westinghouse at its Blairsville, Pa, metals plant. A production line vacuum arc-melting furnace has been adapted with an ultrasonic transducer, vibration from which causes a small, equiaxed structure in the metal ingot. Such a structure ensures better mechanical properties. Several alloy steels and 316 stainless have been handled successfully.

- **Peninsular Metal Products Corp abandons its automotive supply business** by mid-summer. The Detroit concern, supplier or trim for Ford, Chrysler, and AMC, is closing because automakers are using less, and lighter, trim, and because of high labor costs. Its two wholly owned subsidiaries, Brass Forgings Co and George L Nankervis, will continue to operate.

- **Chemical milling is being used to remove the work-hardened surface** resulting from milling operations on an SAE 4140 clutch part. Part simply goes through a series of chemical etching and rinsing tanks. There is no need to mask the part. Same company has successfully applied chemical deburring to several steel parts.

- **Development of low-cost carbide-tipped cutting tools** through an electrophoretic deposition process (*AM*—May 18 '59, p 138) is the goal of an Air Force (Air Materiel Command) contract just awarded to Vitro Corp of America. Coating compositions will range from 65-98% tungsten carbide, 1-10% titanium carbide, 5-15% tantalum carbide, 3-20% cobalt, and possibly small amounts of beryllium, zirconium, and columbium carbide.

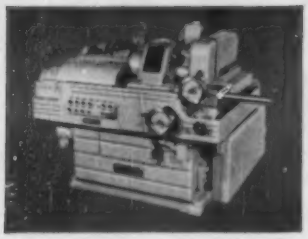
- **Western experts were flabbergasted by Soviet achievements in automation** shown at the First International Congress on Automation held in Moscow. The Russians have skipped the intermediate steps the West had to make. The consensus of Westerners after touring the Soviet Institute of Automation and Telemechanics was that it was far ahead of anything in the West, with only MIT approaching it. "We've been a bit shattered," said one Western delegate. "We never dreamed this level had been reached."

- **First Spanish machine tools to be shown in the U S** made their appearance last month at the International Trade Fair in Chicago. Five Spanish manufacturers were represented by seven machines. Prices ranged from $298 for a bench drilling machine to $4043 for a No. 4 universal milling machine. All prices are FOB the factory in Spain. For details see p110.

- **Soviet auto manufacture still falls far below Western levels** despite recent efforts. Passenger car output has just about doubled in ten years, going from 64,000 in 1950 to 125,000 units in 1959. About three-quarters of Soviet vehicle manufacture is given over to truck production.

THREAD GRINDING COSTS TOO HIGH?

Here's How a Modern Ex-Cell-O can Increase Production and Lower Your Labor Costs

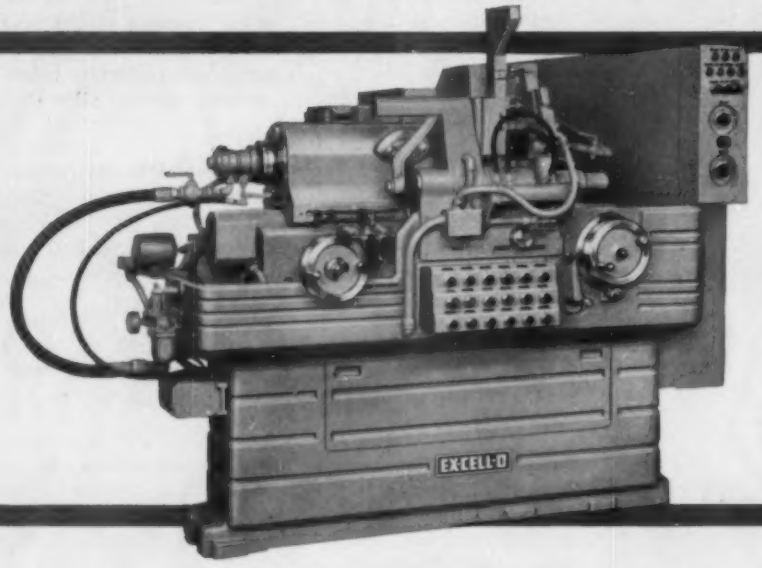


1939—Style 39 Ex-Cell-O Internal Thread Grinder, then the fastest of its kind, produced 17 automotive steering gear ball races per hour. It had power wheel dresser, automatic dresser compensation and automatic wheel feed.

1946—The part's the same, but the manufacturer has turned to a postwar Ex-Cell-O Style 39-A Precision Thread Grinder with fully automatic grinding cycle, including automatic wheel dressing at predetermined intervals. Operator simply loaded the part, reset the size handwheel and pressed the start button. Production increased to 24 parts per hour.

1960—Modern Style 39-A, today produces the same basic part but now at a rate of nearly 60 parts per hour. This powerful, versatile machine has a high-speed workhead, high-frequency Bryant Grinding Spindle, automatic loading, unloading and cycling. It requires only the part-time attention of one unskilled operator.

SEE EX-CELL-O'S BOOTH 946, MMT PE



TOMORROW—Will you have a similar long-run part, or perhaps pinions, worms, taps, thread gages, lead screws, missile components or other special parts that cannot be rough- or finish-ground economically on your present equipment?

Your local Ex-Cell-O Representative can show you how modern Ex-Cell-O Precision Thread Grinders can substantially reduce the cost of producing a wide variety of your large and small threaded parts. Call him today, or write direct for details on the complete line of Ex-Cell-O Internal, External and Universal Thread Grinders for every toolroom and production job.

60-35

EX-CELL-O FOR PRECISION

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • CONTOUR PROJECTORS • GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • RAILROAD PINS AND BUSHINGS • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

WASHINGTON...

Depreciation policy survey...

The long-expected Treasury Department survey of businessmen's views on tax depreciation policy is finally ready for the mails. The purpose is to get a sharper focus on the depreciation practices of business than is obtainable from a study of tax returns, and to explore the possibility of adopting new regulations.

One possible change that interests Treasury officials is adoption of something like the Canadian bracket system for depreciable items.

The idea is to group all products subject to depreciation into a few broad categories instead of the product-by-product method as used in this country. But before reaching a decision, the Treasury wants to learn from businessmen what the average useful lives of such broad categories would turn out to be, based on current practices.

Manufacturing industries, for example, are asked in the survey to group all their depreciable property into eight categories: steel, brick or concrete buildings; cinder block, frame or sheet metal buildings; land improvements such as roads and fences; power plant machinery and fixtures; furniture and fixtures; transportation equipment; special jigs, dies, and fixtures used only in making particular models; machinery and equipment for general production.

Taxpayers will also be asked for information about the differences between depreciation practices on their own books and their practices for income tax purposes. If the same amount is not charged to depreciation for both purposes, the Treasury wants to know whether it is due to capitalization of different amounts, a difference in useful lives, or a difference in the depreciation method.

If the survey gives encouraging results, the Treasury may try to draw up a new set of depreciation regulations aimed at streamlining and modernizing the system without new legislation. No decision is expected until sometime next year at the earliest.

Boost for Bulletin F...

The Supreme Court thinks a lot of Bulletin F, the Internal Revenue guide-book to depreciation, even if the Treasury Department doesn't.

But in a case involving car rental businesses, the high court gave Bulletin F a place of prominence.

The Supreme Court said: "While it does not have the authority of a regulation, its significance is indicated clearly by the fact that both the taxpayers and the Commissioner point to it as conclusive of their respective views of administrative practice. Likewise it is widely cited by tax authorities, as well as by the Courts of Appeals. A careful examination of the entire bulletin, however, indicates that it clearly supports the administrative practice claimed here by the government."

The case the Court decided . . .

This case involves companies that have been getting a break by selling capital goods as a regular thing before their useful life is over. No one knows for sure how many kinds of businesses are affected other than the rental car agencies involved in the particular case.

The Court ruled that from now on annual depreciation deductions have to be based on the equipment's anticipated useful life to the taxpayer, not its entire useful life. And the salvage value is the price which the taxpayer can normally expect to receive for the item he sells.

Car rental agencies normally sell their cars after 18 months or so of service, and they have been applying a capital gains tax rate to the difference between their sales price and the depreciated value of the car figured in accordance with one interpretation of the law. One example used, for instance, indicates an $1800 sales price on a car whose depreciated value is $1500. The $300 difference will now be taxed at corporate income tax rates (up to 52%) instead of capital gains (up to 25%).

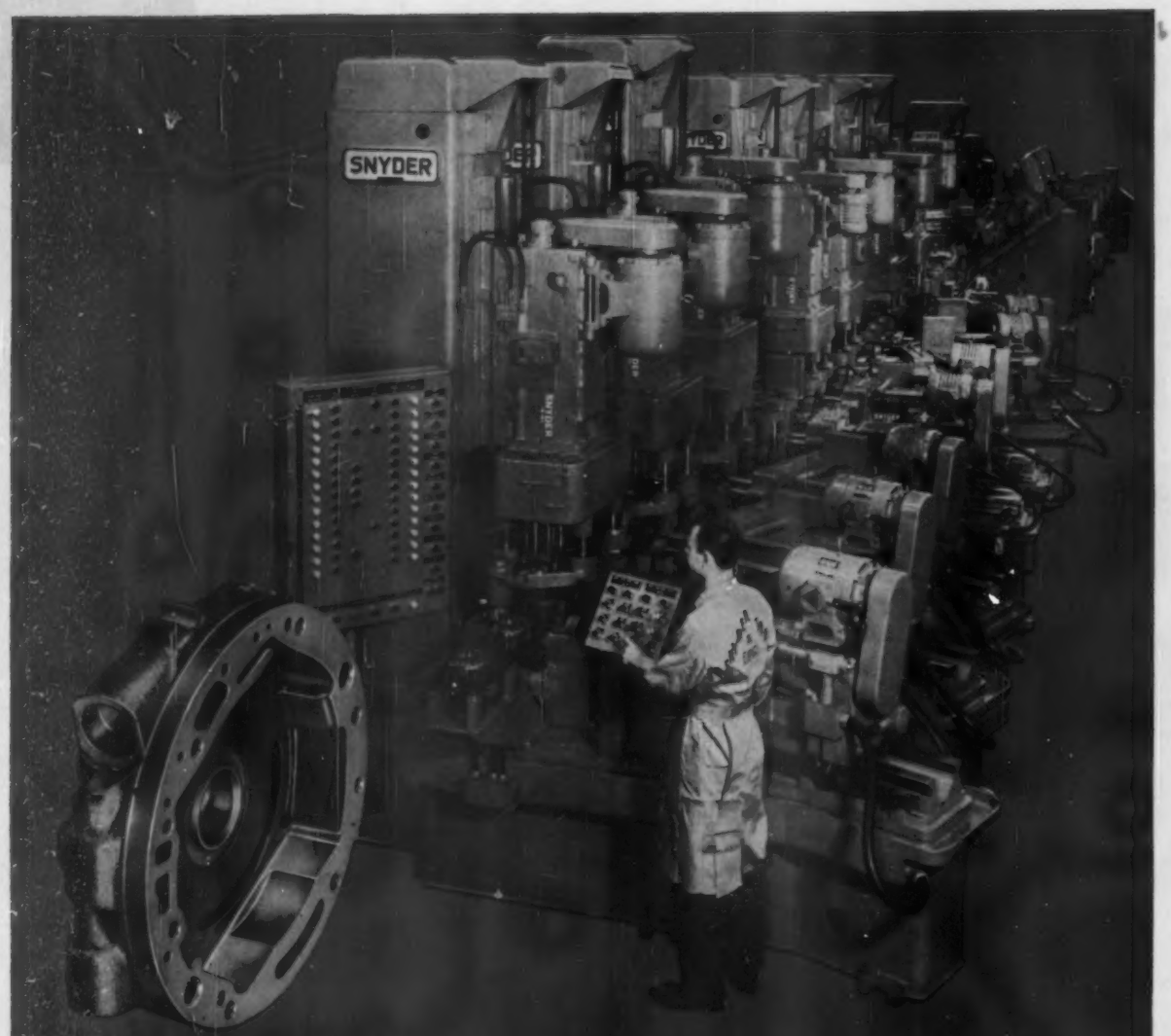
Government vs private plants...

Cleveland Congressman Charles Vanik has stirred up a fuss over the Army's award of a $34.4-million contract to Food Machinery & Chemical Corp to build 1380 armored personnel carriers (M-113).

Vanik claims the vehicles could be built more cheaply in the Army's idle Cleveland Ordnance Plant. A House Armed Services Subcommittee and GAO are investigating Vanik's complaint.

At issue are conflicting Washington policies: One, a statute directing the Army to use government-owned production facilities where it is economical to do so; the other, a Budget Bureau directive which directs the Pentagon to use private plants except when "uneconomical."

The Army invited 17 firms to bid on M-113 production; four companies (FMC, GM, Boeing, and Todd Shipbuilding) submitted proposals. GM proposed to use the Cleveland plant if it got the contract.



SNYDER BUILDING-BLOCK PRINCIPLE MAKES TRANSFER MACHINES VERSATILE, CONVERTIBLE, THRIFTY

Transfer machines built up on the "building-block" principle are old stuff at Snyder and we've built all kinds of them—including the ones that turn corners and bring the part back to where it started from, processed from half-a-dozen angles, gaged, proted, automatically inspected in process, washed and dried and rejects marked for re-processing. Nothing to it if that's what the job calls for. We call it the Snyder Building-block Principle.

Here's an example of a fairly simple Snyder building-block transfer. This 55 station machine performs 74 operations on an automatic transmission pump body, drilling, reaming, tapping, gaging and probing 180 parts an hour at 100% efficiency. Any or all of its 22 segments can easily be converted to perform comparable operations on other parts. Also, the number of segments can be reduced or increased at any time, as need dictates. Your inquiries are invited.

SNYDER
CORPORATION
(Formerly Snyder Tool & Engineering Company)
2400 E. LAFAYETTE—DETROIT 7, MICHIGAN
Phone: LO 7-0123

DETROIT...

Lubeless chassis...

European cars will have no monopoly on the lubeless chassis. Persistent rumors since last year of the imminent arrival of "greaseless" cars on the U S market will be confirmed when the 1961 Ford, Mercury, and Continental lines are introduced later this year. So far, it cannot be determined if the other Ford cars, Falcon, Comet and Thunderbird, will have this feature, or how extensive it may be on General Motors and Chrysler products. The burnoose of secrecy is settling more firmly over Detroit now as the new model year approaches.

By "greaseless" is meant that cars will be able to operate without any re-lubrication for from 15,000 to 100,000 miles. One authoritative estimate gaged lube life as anywhere from two years to the life of the vehicle. Variations in driving conditions in distant areas across the United States make it almost impossible to estimate exactly how much time or how many miles may elapse before service is required.

Ford will not follow what has long been believed the shortest route to extended lube life—nylon or teflon bearings. It has proved impossible so far to develop a seal that will prevent the entry of dirt and grit—bitterest enemies of these plastics, second to service station operators—into the bushings over long periods of time.

Ford trucks now use nylon kingpin bushings for the front axle, and these are expected to be lubricated at normal intervals. The lubricant flushes out any dirt that may have entered and, in addition, the grease acts as a seal against the entry of new dirt. On the other hand, some nylon bushings in less abused applications, such as Chevrolet, Chrysler, and Rambler steering linkage, never need lubrication.

However, look for Ford to use a molybdenum-disulfide lubricant sealed in with rubber and plastic caps applied at the factory. Later, when service is needed, another shot of the special lubricant will prepare the car for its second period of extended lubrication.

The Ford system will include a method of removing plugs at the lubrication points and replacing them with conventional grease fittings when lubrication becomes necessary. The fittings will be removed and plugs reinstalled after the chassis is greased.

Despite assurances from some quarters that in such an arrangement conventional fittings could remain in place, and the lube joints greased with common chassis grease at regular short intervals thereafter, molybdenum-disulfide is not compatible with other forms of grease in general use today.

Oil-change interval extended...

Still another rumor that has never been completely denied, or confirmed—the 6,000-mile oil-change interval—has been firmed up, but with reservations as to how far across the board of Ford Motor products it will extend.

Fast start for 1961 models...

The 1961 model year auto production race will get off to one of the fastest starts in history. Production in October will be at an all-time high, according to *Ward's Automotive Reports* tentative advance schedule which shows that more than a half million 1961 models will be built in September and another whopping 685,000 new units in October, for the greatest production total for those two months together in the last ten years. A firm market in October may encourage manufacturers to gun production schedules for November and December in an all out drive to hit the fourth quarter all-time high set in 1955. That mark stands at 1,950,000 units.

Earlier new model introduction dates this year will be set to occur well ahead of the National Automobile Show in Detroit on Oct 15.

Comet glows...

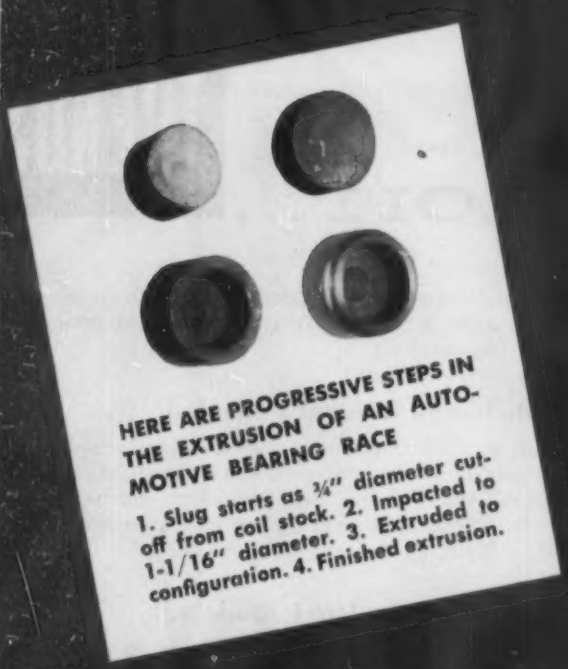
Registration figures for April show that Comet, in its first month in the sales window, outsold its showroom competitor, Mercury, by more than four percent.

Comet paced Mercury in 22 states, plus the District of Columbia, and chalked up a total April registration of 15,148.

Though it ranked no higher than fifth place among compacts during its first full month, Comet's registration is surprising, for not all Lincoln-Mercury dealers possess a Comet franchise, and those that do had only 17,500 of the cars on hand April 1.

New tiny truck...

Ford Division can now deliver a "truck" with a 96-in. wheelbase. This P-100 parcel delivery model can be fitted out with a variety of bodies with loading spaces up to 250 cu ft. It will be powered by either the 90-hp Falcon or 139-hp Ford truck engine.



HERE ARE PROGRESSIVE STEPS IN THE EXTRUSION OF AN AUTOMOTIVE BEARING RACE

1. Slug starts as ¾" diameter cut-off from coil stock. 2. Impacted to 1-1/16" diameter. 3. Extruded to configuration. 4. Finished extrusion.

"in COLD EXTRUSION SUCCESS DEPENDS ON LUBRICATION"

and success is yours when you use

EXTRUDOIL #51 DO CONCENTRATE

MACCO EXTRUDOIL #51 DO CONCENTRATE

- REDUCES PRODUCTION COST . . . INCREASES PRODUCTION DUE TO LESS DOWN TIME BECAUSE OF TOOL CHANGES
- FREER FLOWING OF METAL ASSURES MAINTENANCE OF ABSOLUTE TOLERANCES
- CUTS INVENTORY COST — ONE LUBRICANT DOES *ALL* THE JOBS
- CUTS DIE TRY-OUT TIME

Why is Macco Extrudoil #51 DO Concentrate the first choice of experienced cold extrusion men? The answer is easy . . . Macco research and development, working hand-in-hand with leading extrusion equipment manufacturers, developed this Extrudoil to meet the distinct needs of cold extrusion. Result—today Macco Extrudoil #51 DO Concentrate is far ahead of the field . . . proved in production beyond question . . . used every day in the extrusion of screws, bolts, nuts, bearing races, spark plug shells, worm shafts, gears, tappet bodies, sleeves. If you are now engaged in cold extrusion, or even thinking about it, it will pay you well to talk to a Macco engineer. There's one in your area. If you don't know him, write, wire or phone us. We'll have him see you.

Get the facts . . . find out for yourself why

THE METALWORKING INDUSTRY LOOKS TO MACCO FOR LEADERSHIP

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CIRCLE 236 READER SERVICE CARD

AIRCRAFT and MISSILES... TRENDS

Minuteman beats target dates...

The Air Force is compressing development time on the Minuteman ICBM project, expects to have the first missile units operational next summer, one year ahead of time.

Two important phases in the development cycle are being conducted simultaneously—the preparation for long-range flight testing at Cape Canaveral, which will get underway in about three months, and a Seattle test program in which Boeing, the assembly contractor, will check out compatability of components.

Feasibility of launching from underground silos has been demonstrated in eight tests, instead of the 18 initially scheduled. Thiokol has static fired a flight-weight version of the first-stage engine, and Aerojet-General has done the same on the second-stage rocket. A decision will be made shortly on whether Hercules Powder Co or Aerojet will build the missile's third stage.

Business in the Southwest...

Although two firms were still being harassed by "hit-and-run" labor strikes, there has been little change this summer in the work-load status of the Southwestern aircraft industry. A few minor contract awards continue to dribble in.

Chance Vought Aircraft and Bell Helicopter have been plagued for several weeks with labor trouble. A Bell spokesman said he believes their troubles are on the mend now. Chance Vought and UAW Local 893 were exchanging bitter statements, but "some progress" has been reported.

On the new contract award front, Chance Vought's Electronics Division got a $3.3-million contract for continued development and manufacture of an advanced actuator system for the Minuteman.

New rocket motor...

At McGregor, Texas, Rocketdyne Division of North American reported the design of a variable-thrust, long-duration solid propellant rocket motor suitable for propelling rocket drones at twice the speed of sound at altitudes to 70,000 feet. The system would use Rocketdynes's variable area nozzle (*AM/MM*—May 16, '60, p75) to achieve maximum versatility in the programming of high altitude, supersonic target drone missions. The proposed propulsion system would employ ammonium nitrate propellant similar to that used in the Temco Teal target drone. In operation, the variable nozzle would be preset to the desired thrust level. Nominal boost burning time of 45 seconds would push the drone from 35,000 to 70,000 feet. From a launch speed of about Mach 0.7, the unit would be boosted to a top speed of about Mach 2 and would cruise at this speed for 10 minutes. In cases where the launching aircraft is flying at lower or higher speeds, or at a different altitude, boost phase could be set for longer or shorter durations as required.

Northrop diversifies...

Northrop Corp, Beverly Hills, Calif, has purchased 100% of the stock of Acme Metal Molding Co, a leading manufacturer and distributor of architectural aluminum products.

The acquisition marks Northrop's first move into the commercial metal products field and is keyed to the aerospace and electronics company's program of diversification. The subsidiary will continue operations under its present name and management, but will be operated by Northrop's Norair Division.

Accurate cost data required...

Legislation requiring defense contractors working on fixed price incentive contracts, used by the Navy and the Air Force in aircraft and missile procurement, to certify that their costs are accurate was approved by the House Armed Services Committee, headed up by Representative Carl Vinson (D, Ga).

Vinson had complained that the savings — on which the contractor is awarded a profit—are often due to high cost estimates during negotiation. In its report the committee said that the legislation will assure that "the incentive profit over the normal profit will be the product of the contractor's action in performance rather than artificial pricing in negotiations for target price."

More B-58 bombers...

Senate Preparedness Subcommittee, headed by Senator Lyndon B Johnson (D-Texas), wants the Air Force to buy more B-58 medium-range bombers to replace obsolescent B-47s, says U S nuclear strike forces will continue to need manned bombers even while stocks of ICBMs are being built. The Air Force has so far invested $2.7 billion to design and develop the B-58 and to buy 65 aircraft. Production now runs at only three per month to fill outstanding orders. Fiscal 1961 budget provides financing for last 32 of the current production run.

"The fabulous '60s, with tremendous technological advances predicted, will require this type of perfectionist precision tool . . . and, son—

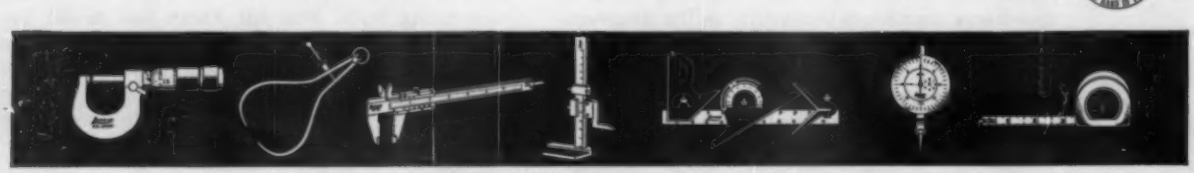
only Lufkin offers you a decimal radius gage!"

This unique radius gage is an excellent example of why Lufkin is the new leader in precision tools. It is designed to save the craftsman time and effort . . . to give him greater accuracy with readings from **.010** to 1.000, and no burrs to throw him off.

Hardened stainless steel blades, too, for a lifetime of accurate service. And the holder for this No. 75 gage is 4½" long, reaches into small, out-of-the-way places. Adjusts over 180° arc to keep blade edge perpendicular to surface measured.

Durable vinyl case holds blades in individual pockets, makes selection fast and easy.

See your industrial distributor. He knows precision tools and can show you how Lufkin leads in design and craftsmanship. His stock is maintained to fit your needs. LUFKIN, Saginaw, Mich.



MACHINE TOOLS...

Boom in Britain...

LONDON—The International Machine Tool Exhibition, staged every four years at Olympia here in London and just over, comes at a time when the British machine tool industry is enjoying almost unprecedented demand.

Many builders have a 12 to 24 months' backlog. Some report full bookings into 1963. But the truth is that current prosperity is tied closely to the automobile industry's expansion programs in the United Kingdom and in western Europe.

Builders selling high production and other special machines designed for the automotive and a few other mass production industries are virtually overwhelmed with orders. Companies making standard general-purpose machines, on the other hand are doing very well, but their backlogs are much lower.

There is a race on among the big automobile companies to see which one can expand the most the fastest. Car makers in many cases are backing their machine tool orders with generous progress payments to builders.

An increase in exports this year of 43% over the same period in 1959 has delighted British builders—and the government even more.

A bit of uneasiness nevertheless runs through the industry here. The government's boosting the bank rate to 6% hardly evokes cheers.

While tighter money will have little or no effect upon the buying programs of important customers, builders feel that smaller manufacturers may well be constrained from placing orders.

The feeling is that the European automobile industry, pouring out cars from assembly lines as never before and now in the midst of a third expansion of facilities, is headed for troubled times a few years ahead.

Some managements of automobile companies, in fact, are of the opinion that their industry over here will have much too much capacity by 1962. The current situation resembles that in the U S auto industry during 1955-1957.

Apprehension about the wisdom of such rapid expansion of the European automobile industry is not confined to the British machine tool industry. It is shared by French, German, Swiss and Italian builders, who wonder whether today's prosperity is insured by borrowing from tomorrow's demand.

But even with such foreboding, the British machine tool industry cannot feel other than good in the present flush period. And U S builders who had the foresight to establish their capacity here are participating in this prosperity. They wish plants back home could do as well.

Anglo-Chinese trade snag...

British machine tool builders who hope to do business with China are pressing their own government to relax restrictions on imports.

Robert W Asquith, chairman of the Asquith Machine Tool Corporation, was a member of a 16-man British team of industrialists who talked with officials of China's Import Trade Commission in Peiping in May. He reported that the Chinese are reluctant to place any more machine tool orders in Britain—and probably won't—until the British Board of Trade lifts licensing and quota restrictions reimposed last fall.

The Chinese are reported to be coming up with a development plan that will call for sizeable purchases abroad of capital equipment. They intend to send to western Europe this summer a buying mission from the State Machine Import Corp. Whether the mission comes to London seems to hinge on whether the Board of Trade quickly moves to atone for what Mr Asquith has termed its "blunder."

US and European builders meet...

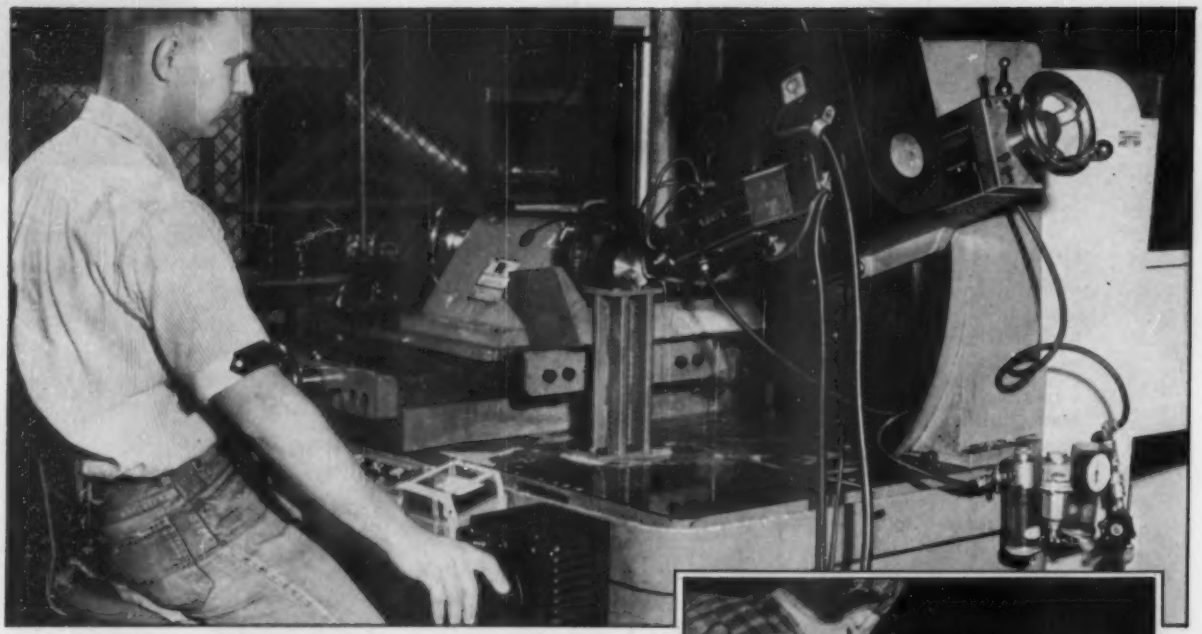
A meeting between the European Committee on the Coopefation of Machine Tool Industries and representatives of the National Machine Tool Builders Association was held in London on June 29. Another meeting of the two groups is scheduled for Chicago during the Machine Tool Exposition—1960 in September.

European builders are concerned about developing a workable long-term program for financing machine tool sales in world markets in competition with Communist countries. They hope to interest U S builders in going along.

It is suggested that such a program could be ironed out at governmental levels through an agency that soon will be set up to succeed the Organization for European Economic Cooperation (OEEC). The new agency will include the United States, Canada, and western Europe.

The Communists, particularly the Czechs, are reported to have been taking business on seven-to-ten years' credit terms—with no down payments in some cases. Only way to meet such competition is to get the backing of Western governments.

BF.



This special machine at Rocketdyne is designed so that angular adjustments of Bellows-Locke Drilling unit can be made in a vertical plane. Also visible is the Bellows Lubri-Air® Control unit (right) which cleans, lubricates and regulates the air supply.

BELLOWS-LOCKE "Packaged" DRILLING UNITS

PROVIDE A DOWN-TO-EARTH SOLUTION FOR ROCKETDYNE'S SPACE-AGE PROBLEM

This machine is similar to the one in the main illustration, except that the Bellows-Locke Drilling unit is mounted in a horizontal plane. Work-holding fixture also indexes on horizontal axis. Between the two machines, any angular relationship between two or more holes can be produced.

One of the most critical components of a liquid-propellant missile propulsion system is the fuel injector head, containing hundreds of very small holes, each of which must be highly accurate not only as to shape and size but also as to location, angle and finish. Because Rocketdyne, a Division of North American Aviation, Inc., is deeply involved in missile propulsion, both in the experimental phase and in the manufacture of engines which have reached the production stage, it must produce fuel injector heads in a wide variety of designs.

To meet the special demands of accuracy and flexibility, Rocketdyne engineers designed special drilling machines, incorporating Bellows-Locke Model 5-E Drilling units. These compact, versatile work units are completely self-contained, will operate at any angle in any plane, and feature a built-in valve controlling an adjustable air powered rapid advance and retract as well as an adjustable, precision hydraulic feed.

With the Bellows-Locke Drilling units, Rocketdyne holds tolerances to ± 0.0005 inch on holes less than 0.080 inch in diameter, while on holes that size and larger tolerances are held to ± 0.001. Center distances between holes are held to ± 0.003 inch. Commonly, two holes are drilled at an angle to intercept a vertical hole at a given point. The tolerance on this intercept is ± 0.001 inch and is held readily with the Bellows-Locke units.

Thousands of users have found the Bellows-Locke Model 5-E the ideal solution to their drilling problems. Chances are it can prove valuable to you, too. Write today for free Bulletin BL-5RA. Address Dept. AM-760, Bellows-Valvair, Akron 9, Ohio.

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DIVISIONS OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

784-C

MATERIALS...

Quick-frozen alloys...

Atomic structures of metals never seen before are found in a series of new alloys created at Caltech—California Institute of Technology in Los Angeles. Combining atoms of gold, copper, silver and other metals, contrary to the rules of conventional association, the alloys are stronger than previous alloys and researchers hint at electrical and magnetic properties far beyond conventional metals. Signs indicate the new alloys may lead to metals highly resistant to corrosion and capable of conducting larger quantities of electricity.

Alloying technique consists of using a force 6000, or more, times the force of gravity (G) plus instantaneous cooling of molten metal. Thus, the atoms are mixed and quick-frozen in their new relationship. Quick-freezing prevents the atoms in the mixture, readily interspersed while molten, from realigning themselves into normal patterns as they do when cooled slowly.

Developed by Dr Pol Duwey, professor of mechanical engineering, with the help of graduate students Ronald H Willens and William Klement, Jr, the method of alloying is to blast hot droplets of metal from a shock tube gun against the inside rim of a wheel. The rim of the wheel is lined with copper, cooled to –314 F by liquid nitrogen. Gas pressure hurls the droplets against the wheel rim at nearly 500 ft per sec. Experiments have produced alloys of germanium and silver, gallium antimonide and germanium, gold and silicon, and copper and silver.

Paint saver...

Fungi can "spoil" paints. Mold and mildew give the painted surface a gray sooty look that is not, as it may seem, dirt. The problem is especially bad in humid climates. Said to be one of the most effective paint fungicides is a chemical tradenamed "Metasol 57," produced by Metalsalts Corp. This material is a specially prepared phenylmercurial propionate containing 57% mercury. In preventing microbial action, it has a high level of activity and works in both oil-based and water-based paints.

High-temperature "fabrics"...

For weaving into fabrics useful in the reentry parachutes needed for manned satellites, all kinds of materials were evaluated. Among these fibers were metals, ceramics, glasses, inorganic and organic polymers and single-crystal systems.

Tests did not concern actual parachute design, but only materials. Emphasis in the research was placed on forming fibers from the melt, and on melt spinning, because of limitations in present techniques for making metal and high-melting-point ceramic fibers from solid material.

Fine wire from nickel chromium and cobalt chromium alloys appears most immediately suitable according to the U S Air Force report prepared by Arthur D Little, Inc. The techniques may lead to some highly practiced new engineering materials.

More zinc-titanium...

Calling its product Zilloy-20, The New Jersey Zinc Company is now offering a 0.8% Cu, 0.12% Ti alloy of zinc. In company with zinc-titanium alloys produced by other companies, licensed by New Jersey Zinc, and described in AM/MM, the new alloy has remarkable creep resistance. Its inverse creep rate at 77 F and a stress of 10,000 psi is 5000 days for an elongation of 1%. Conventional 1% Cu-zinc alloy creeps more than 1%, under these conditions, in a single day.

A coefficient of expansion approximately equal to that of steel is an additional advantage. Also, the alloy—which is dispersion hardened—has a very high resistance to grain growth hence can be soldered or welded without destroying the properties of the metal adjacent to the joint. Tensile strength is up 25%.

Substantial new markets are anticipated for the alloy, which is the first radical innovation in rolled-zinc alloys in their entire history. Cost per sq ft of Zilloy 20 is: 290% of galvanized steel, 40% of 70/30 brass, 140% of 1100 aluminum and 45% of type 430 stainless.

Licenses are available to any roller or producer, and have been granted at a nominal royalty to American Zinc, Lead and Smelting Co; Bridgeport Rolling Mills Co; Hydrometals, Inc (Hydro-T-Metal) and to Matthiessen & Hegeler Zinc Co.

Vinyl-clad metals...

The Clad-Rex Division of Simoniz Company has developed a new system for laminating vinyl to metal. The resultant material, called Clad-Rex 102, combines the ultimate properties of the metal (steel, aluminum, or their alloys) with the optimum properties of vinyl. The laminate can be worked with conventional metal-forming equipment, and can withstand temperatures up to about 325 F.

XLO EX-CELL-O FOR PRECISION

A. Standard DB 24 Spindle
B. DB 50 Motorized Spindle
C. DB 25 Square Body Spindle
D. DB 50 Motorized Quill-Type Spindle
E. DB 22 Square Body Spindle
F. Standard DB 22 Spindle

57-90

Greater Accuracy—with Ex-Cell-O Precision Boring Spindles

No one need tell you of the proven superiority of Ex-Cell-O precision boring spindles where close tolerances and fine finishes are required. But, did you know that these same Ex-Cell-O boring spindles have been used as replacement units for years?

Produced in belt-driven, standard motorized, or high frequency motorized styles, these Ex-Cell-O precision spindles are equipped with XLO Precision bearings for maximum spindle rigidity, long life and smooth operation. Permanent bearing lubrication reduces maintenance costs, prolongs bearing life.

For complete information, why not get in touch with your local Ex-Cell-O representative or, if you prefer, send direct for bulletin 25477.

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CIRCLE 239 READER SERVICE CARD

WHAT'S AHEAD... in Metalworking

TRENDS

Metalworking expects pickup in fourth quarter...

The expected summer lull appears to have arrived, according to reports from diverse segments of the metalworking industry.

Steel production should begin to rise again in August, possibly in late July, according to the major producers. Before this happens, several more basic steel producing units are scheduled to close down. July is expected to be a bad month for the industry, with output skidding to below 60% of capacity, the lowest point in a non-strike period since the summer of 1958.

The August pickup is predicated on a general pickup in business, new auto production getting into full swing, and the awaited increase in orders from appliance manufacturers.

Metalworking job shops report steady business, though one or two dropped off slightly last month. Backlogs, in general, are up 5 to 10% over last year at this time, and prices are stable. The outlook is for 1960 to be about 5% ahead of 1959.

Foundry operations, slipping since early this year, are expected to pick up in the second half of the year. Gray iron founders anticipate a 5% increase in business in 1960. Malleable founders should hit normal operating levels by September, after the usual, slow summer business.

Drop forgers report operations below normal levels. Faced with continued reductions in defense contracting, several forgers are attempting to diversify as much as possible. For some this has worked out quite well; for others, not at all.

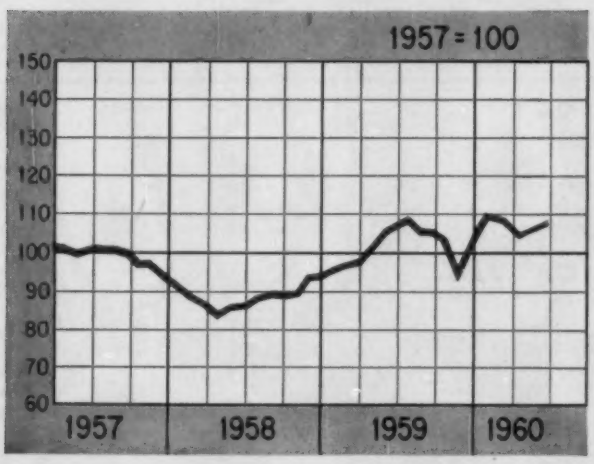
Railroad car producers, though reporting increased production, admit that orders are not coming in and that production will taper off during the present quarter. Outlook for the year ranges from equal to 1959 to down about 10%.

The major appliance manufacturers still suffer from slow sales and ever-increasing inventories. Many workers have already been furloughed and further layoffs are expected before imbalances can be corrected.

Electronics firms on the West Coast are running about 12% ahead of last year but, despite a picture of overall strength, components sales have been soft, especially in the last few months. Among factors cited for this situation are (1) uncertainties in government defense spending; (2) trimming of costs and overhead by major users; (3) foreign competition, especially from the Japanese.

Plating shops expect their usual summer slump, but report that current business is holding steady. When business picks up in the fall, as most platers predict, the pickup should boost 1960 to a level anywhere from 5 to 20% ahead of 1959.

Sales of cutting tools, gages, and fasteners by mill supply houses continue to lag. The mid-April price adjustment, which led to lower prices to the customer and bigger margins to the supply houses, has brought about an unstable price situation. The increased discount has given some distributors a chance to cut prices on cutting tools for the first time, and observers say manufacturers aren't keeping their distributors in line as well as they used to.

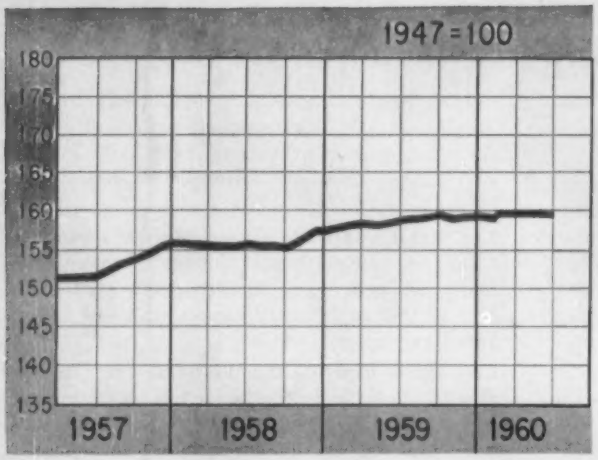


AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	JUN. Estimated	MAY Preliminary	APR. Revised	MAY Year Ago
Total Index	**108**	**107**	**106**	**107**
Machinery	**103**	**102**	**101**	
Electrical Machinery	**115**	**114**	**107**	
Autos	**121**	**115**	**111**	
Other Transportation	**92**	**89**	**97**	
Other Metalworking	**109**	**106**	**109**	

TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	JUNE Estimated	MAY Preliminary	APRIL Revised	MAY Year Ago
Total Index	**159.9**	**159.7**	**159.8**	**159.2**
Metalworking Machinery	**191.2**	**190.4**	**184.9**	
Other Machinery exc. Electrical	**173.1**	**173.0**	**169.6**	
Electrical Machinery	**160.8**	**162.2**	**160.4**	
Fabricated Metal Products	**147.8**	**147.9**	**148.8**	

Business outlook good, will get better . . .

Auto sales during the first twenty days of June were at the highest level for the month since 1955. In the June 1-20 period, domestic-built new car sales averaged about 20,300 units compared with less than 20,000 units last year and 24,300 cars in 1955. However foreign-built car sales in 1955 were only a small fraction of what they are now. So the auto sales picture continues bright and provides strength for the overall outlook.

On the other hand, May retail sales according to preliminary estimates fell by 2.5% from the all-time April peak. Actually retail sales in April were just too fat to last. The June sales figure will probably show a solid improvement over May, perhaps as much as a 2% gain for the one month. The normal level for retail trade in the second quarter will turn out to be an average of the very high April and a good May.

The expected rise in housing starts has not yet materialized. The May figure held at 1.3 million units (annual rate). But we look for some upward revision in this statistic to make May the highest month in new housing starts for the year so far.

During the past few weeks we have been showered with a succession of economic statistics, the majority of which are cheerful reports. Overall they indicate that business in general is good and will improve in the months ahead.

The Federal Reserve Board's index of industrial production increased in May for the first time since January. The May gains extended to all lines with the single exception of steel. Industrial output has not yet surpassed the January peak of 110 (1957=100) but that rate is sure to be topped in the fall.

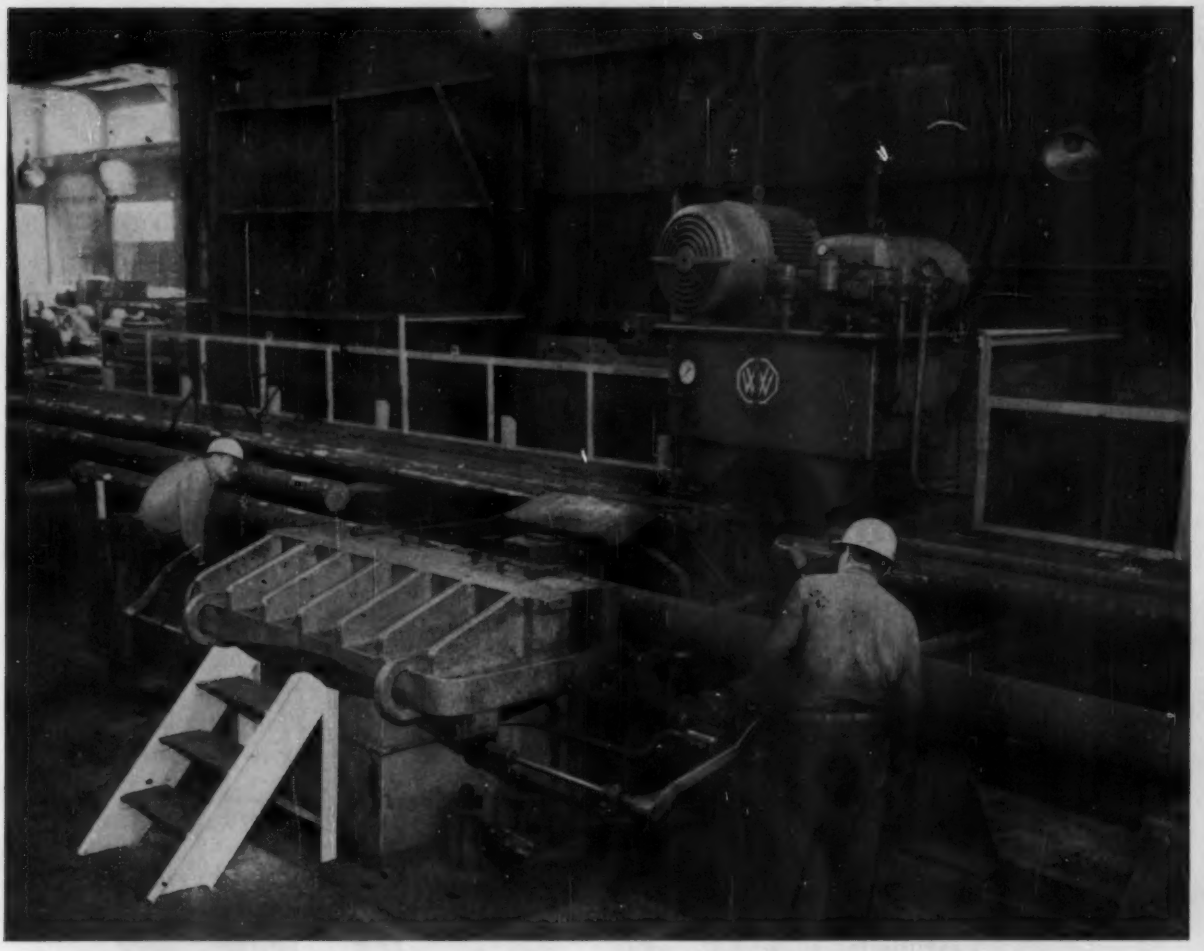
Personal income just fell short of the $400 billion dollar goal in May. But this level of consumer income, no doubt, was passed in June.

Contract awards for heavy (engineered) building are very high. The total dollar volume for the first 26 weeks of 1960 is 9% ahead of the figure for the same period last year.

WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949=100)*	153.9	152.8	159.3
Steel ingot operations (thousands of tons)	1,560	1739	2,215
Electric power output (million Kilowatt hours)	14,213	14,053	13,749
Production of automobiles and trucks	140,319	137,641	127,217
Engineering construction awards (Eng. News-Record—thousands)	686,384	458,112	474,066

QUARTERLY BUSINESS INDICATORS	Latest Quarter	Preceding Quarter	Year Ago
Gross National Product (billions)	500.2	483.5	470.4
Expenditures of new plant and equipment (millions)	37.5	37.0	33.3
Profits after taxes in primary iron and steel industry (millions)	400	204	374
Profits after taxes electrical machinery industry (millions)	264	352	246
Profits after taxes machinery (except electrical) (millions)	271	282	223
Profits after taxes in motor vehicles and parts industry (millions)	564	314	523
Motors and generators new orders index (1947-1949=100)	169	169	155

*Seasonally adjusted



Williams-White 750-ton Hydraulic Bender and Straightener at work for one of the nation's major steel producers

750-ton push--controlled to fraction of inch solves bending and straightening problems

Taking the kinks and curves out of square bars, rounds, flats or angles calls for a heavy hand with a light touch — the kind of easily controlled power delivered by Williams-White Hydraulic Benders and Straighteners.

Ample power and handling convenience team up with other built-in Williams-White advantages like these: *Massive frame structure; a heavily guided ram which is independent of the hydraulic cylinder; and wide open die space for easy access to the work area by crane or roller table loading.*

When you look into the future of your metal forming operations, look into the flexibility and reliability of Williams-White Hydraulic Benders and Straighteners. *Write for free Bulletin No. 73.*

107th year

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If you make hardened Stainless Steel parts...

How would you like to eliminate tempering, straightening, scaling?

Armco 17-4 PH Stainless Steel makes this possible!

Armco's special stainless steel, 17-4 PH*, offers you these money-and-time saving opportunities because:

1. It has strength and hardness equal to or better than those of the standard hardenable stainless grades such as Types 416 and 420. In condition H900, typical tensile strength is 200,000 psi and Rockwell hardness is C44.

2. It has corrosion resistance comparable, in many applications, to Types 302 and 304 stainless, much better than any of the regularly hardenable stainless steels.

3. It can be completely machined in the solution-treated condition, then hardened by heat treatment as low as 900F. This low temperature hardening eliminates the need for tempering, troublesome distortion, and scaling. Only a light heat tint is produced that doesn't affect dimensional tolerances. If required for appearance or service, it can be removed easily by a light pickle.

For the parts *you* make that must have both high strength and top corrosion resistance, it will pay you to try Armco 17-4 PH. It has replaced not only standard stainless grades, but low allow steels and high alloy metals in a wide range of applications. Write us for complete information on properties and fabrication. Armco Steel Corporation, 2120 Curtis Street, Middletown, Ohio.

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Armco Division • Sheffield Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation

American Machinist / Metalworking Manufacturing ESTABLISHED 1877

Make the Roller Coaster Less Steep

Do we have a national defense production policy? If we do, it is nowhere to be found.

For years the administration and Congress have blown hot and cold about defense spending.

Mr Krushchev hands us sweet talk and says that war is the farthest thing from his mind. We love it, purr, and then rush to take a look at the possibility of cutting down on weapons.

Then the U-2 incident comes along . . .

and Mr. Krushchev makes a shambles of the summit meeting. Whereupon we hasten to think about bigger defense production.

This unsatisfactory situation has gone on for a long time. First a peace scare, and next a war scare. In any event, defense spending—and that means production—goes up one year and down another; and it goes up and down in between. It never attains any stability.

View the miserable situation in the aircraft and missiles industries. Critical problems of readjustment have been created for most companies by the major switch from manned planes to space vehicles, plus drastic cutbacks of contracts in progress. Many manufacturers, shifting for themselves, are going into civilian products.

At the beginning of World War II . . .

there was a desperate shortage of machine tools. So the machine tool industry set out to correct the situation, and did. The same sort of crisis had to be met again during Korea.

But today, as in many times past, Washington seems oblivious to the importance of machine tools to defense production. Oh, yes, a few official and Congressional committees give lip service to it. That, however, is the beginning and the end. Not much if anything is done, except talk, to keep the armed services' holdings modern.

This is in face of warnings in the Johns Hopkins Report that our manufacturing capabilities in producing sophisticated weapons of today and tomorrow will be crippled unless our production equipment is rapidly updated.

With weapons technology advancing at breakneck speed, our defense requirements admittedly must be flexible. Even modest production of the best weapons is infinitely more desirable than prodigious output of outmoded weapons.

But equally desirable is the setting up of a program that has a large degree of stability of production. It can be big or little or in between. But it must have continuity.

The off-and-on schedules . . .

of the past and of the present engender uncertainty, excessive costs, and risk for the supplier to the point at which many companies prefer not to do any business at all with the federal government.

New weapons, it is true, may come into being so fast that they obsolete the old almost before production can get rolling. Even so, a careful study should be made of the possibility of stabilizing weapons production.

The roller-coaster production curve surely can be made less steep and perilous for everybody concerned—the individual company, the individual employee, whole industries, the whole nation—by intelligent forward planning. The curve can be straightened at least by deciding upon a sane and sensible production schedule and then staying with it through hot and cold crises. If this were done, the armed services themselves, industry and the American people would greatly benefit.

Burnham Finney EDITOR

A ROOMFUL of THOMPSON GRINDERS

This is the eighth Thompson grinder recently installed at Jessop which grinds plates and sheets up to 60" X 96" in size.

Jessop precision ground flat stock which is used in gages, dies, verniers and other exacting products.

Pictured above are 4 Thompson Grinders in the Specialties Division of Jessop Steel Company, Washington, Pennsylvania. There are 4 more Thompsons which are not shown in the above photo. All these Thompson machines are grinding to the extremely accurate tolerances and fine RMS finishes that distinguish Jessop's precision ground flat stock.

There are excellent reasons for using 8 Thompsons on this essential production. Mr. Joseph Manfredi, who is responsible for the quality and production of this famous ground flat stock, says, **"We have recently installed our eighth Thompson grinder in this division. We have proven the top performance of these rugged machines for many years. They give us the extreme accuracy and precision we demand—day after day with a minimum of maintenance."**

You may not need 8 Thompson grinders in your operations but it will pay you well to investigate what just one Thompson machine can do toward saving time, improving your products and cutting your costs of manufacture.

Your inquiries are invited.

MMT-PE

THE THOMPSON GRINDER CO.
SPRINGFIELD, OHIO

"Keep Thompson in mind for that daily grind"

SURFACE GRINDERS

As a thousand machine tools begin moving into these buildings, what cost-cutting secrets will they contain? This is the International Amphitheater in Chicago, where the Machine Tool Exposition will have a 10-day run in September. At left is North Hall, the Arena, and South Hall. In the center is Exposition Hall (added for the '55 Show), and right is Donovan Hall, a new addition built to accommodate the even-bigger 1960 Exposition

SNEAK PREVIEW

What you'll see at the Machine Tool Exposition—1960

More than a thousand machine tools —most of them new, some of them radically new, and all of them American made—will make their debut September 6 as Chicago's International Amphitheater opens its doors on the Greatest Industrial Show in the US.

This is the Machine Tool Exposition—1960, in which America's machine tool builders will showcase the end products of five years of intensive resarch and development (since the last Exposition)—and it promises to be a Show worth waiting five years for.

The big question: What does America's machine tool industry have up its collective sleeve? Will the new machines cut production costs? Do they trend toward tape control? Will they incorporate new metalworking principles?

Yes, and more too.

Now Being Set Up

This has been obvious since the morning of June 6, D-Day for moving in the first machines (It takes months to set up a show of this size). First machine tool to move in was a triple-action, 200-ton-capacity, electronically controlled hydraulic press built by Hydraulic Press Mfg Co.

At about the same time, a large horizontal boring machine built by R K LeBlond was unloaded. Both machines were headed for spots near the center of Exposition Hall.

Later in the day, Giddings & Lewis unloaded a huge radial drill headed for a spot near the center of Donovan Hall—the new 80,000-sq-ft addition to the Amphitheater. Because a circus was playing in the Amphitheater that week, a smart publicist borrowed an elephant to push the elephant tool off a flatcar.

An even bigger circus will play the Arena later this month, when the Republican Convention moves in. But the work of installing machines in other halls will continue straight through the Convention.

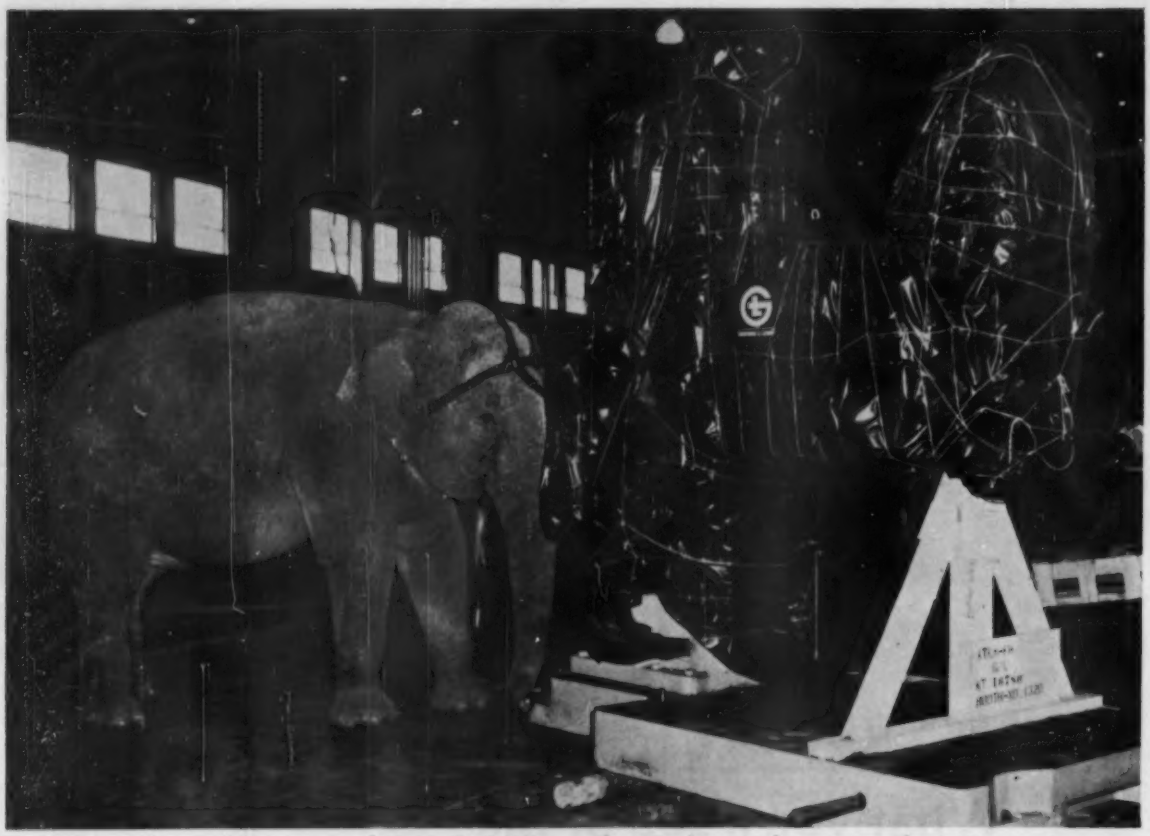
Four machine tool builders (Brown & Sharpe, DeVlieg, Landis Machine, and Warner & Swasey) will probably be pushing for a short Convention—they're slated to exhibit in the central Arena, where the Convention delegates will meet.

The Machine Tool Exposition — 1960, as it is now officially called, will be the sixth such showing of American-built machine tools sponsored by the National Machine Tool Builders Association. Donald McIver, chairman of NMTBA's Exposition Committee, reports that more than a thousand U S-made metal-cutting and metalforming machines will be on display.

Details on nearly half these machines (498 to be exact) have already been received by the editors of *AM/MM*, and indicate that 239 of them will be brand new. Most of the others are relatively new designs, and the September showing will give most manufacturing men their first opportunity to see them in action.

Numerical control will get a big play at the 1960 Show, where scores of completely new machines with such systems can be expected to attract a great deal of attention.

Even so, more than 90% of the



Elephant power, borrowed from a circus playing in the Arena, pushed this G&L Bickford off a flatcar on the first moving day. Truck-mounted cranes, crawler tractors, gantry cranes and a crew of 60 riggers will handle the rest of the machines

machines operating in the Amphitheater, whether high-production automatic machines or versatile toolroom models, will *not* include tape control. But a good half of these machines will either be completely new or substantially improved versions of previous models. Singly or collectively, they provide justification for beating a path to the Amphitheater next September — even if there weren't a piece of tape in sight.

But let's get down to cases, what *will* be shown at the Amphitheater? Here is a sneak preview of some of the machines that will be announced next month and shown at the Machine Tool Exposition—1960:

There will be a 100-hp engine lathe with 48 speeds and a preselect system for both speeds and feeds. An engine lathe will combine numerical control for point-to-point cuts with an electronic tracer for contours. This will be considerably less expensive than full path control.

But if you want a lathe with numerical control of contours, too, it looks like at least five builders will be prepared to supply it, some on engine lathes, some on turret lathes.

For high-production work, where numerical control is less likely to apply, there will be a bar *and* chucking automatic that can be converted from a bar machine to a chucking machine in 30 minutes. There will be a bar machine with a tracing attachment.

Tool Changing Machines

Rotating-spindle machines with automatic tool changing, the new family created by numerical control, will be shown by at least two builders. One will have a pair of machines. The first is a 5-axis machine with a 60-unit automatic tool changer. The head will have two precision spindles, one for heavy milling and boring, the other for high-speed work. In addition, an auxiliary axial-feed spindle can be used to drill, tap, bore, and ream. The second machine is a simpler, 3-axis vertical-spindle machine with a 20-position automatic tool changer.

One line of milling machines will have the spindle motors mounted in the ram instead of on top of it. Another machine, this one a bed type, will have a 50-hp horizontal spindle and a 20-hp universal spindle.

Emphasis on being able to hold close tolerances in production shows up in many machines, but nowhere more than in the grinders. One special bearing race grinder for miniature bearings looks like it will hold tolerances in production of 0.000,050 in. with a surface finish of 3 or 4 micro-in.

One complete line of plain and universal grinders has been completely redesigned. Among the changes is removal of the hydraulic reservoir and motor from the bed to prevent inaccuracies caused by heat buildup. The hydraulic carriage traverse and pressure lubrication system in these machines has been redesigned so that oil pressure cannot lift the carriage and affect accuracy.

Size-control equipment will be much in evidence and one builder has a grinder with a direct-reading indicator that can be used by an *unskilled* operator to gage size on work while it is being ground.

Not all the equipment will be in the big price brackets by any means. One small, low-cost thread and form grinder for precision work was orig-

inally designed for electronics work but has been equipped to do a wider range of small parts.

At the other end of the size scale a planer manufacturer is introducing a "compact" model. This machine, smaller and lower priced than most planers, will have table speeds from 30 to 300 fpm and can supply up to 75 hp from its variable-voltage drive.

Improvements in heavy-duty planers include one that can finish plane at the same time it is double-cut roughing.

Numerical control is going to be in drilling in a big way. In addition to several turret drills with numerical control, there will be a variety of other drilling machines with NC systems.

Improved Gear Cutters

Innovations in gear cutting will include a gear shaper with open-back design to permit through feed for use in automation. A crowning gear grinder will be fully automatic, including the wheel-dressing cycle.

There will be gear shaving machines in which most machine settings are dial controlled to speed setup. An attachment will make it possible to shave any combination of crown and taper.

An automatic gear-inspecting instrument, said to handle as many as 600 gears per hour, has a memory device that accepts or rejects gears and sorts accepted gears into size classifications. It will keep track of changes in the size of gears inspected in order to control production equipment, stopping the gear machines as parts begin to fall out of tolerance.

That is a sampling of the machine tools and developments you can expect to see at the Machine Tool Exposition—1960, which will run September 6 through 16 at Chicago's International Amphitheater. There will be nothing on the main exhibition floors but machine tools, all of them American made.

Back when machine tool exhibits weren't so big, tools, gages, controls, lubricating equipment, and other items of production equipment were exhibited along with the machines.

But this year, as in 1955, the main Exposition will be devoted solely to machine tools, and the other production equipment will for the second time be displayed at the Production Engineering Show at Chicago's Navy Pier. The shows, both of which are staged by Clapp & Poliak—the firm that has managed all six machine tool shows for NMTBA—will run concurrently, but with staggered hours. In this way, hardy showgoers can start at the Amphitheater at 10 am and finish at Navy Pier at 10 pm.

First machine to arrive for the Machine Tool Exposition—1960 was this 200-ton, triple-action hydraulic press. It has electronic controls, will be shown by Hydraulic Press Manufacturing Co

Additional competition for your time, and incentive for going to Chicago, will be provided by the rival Second International Coliseum Machinery Show, sponsored by A Byron Perkins. This show will include machines built by firms in the United States and in Italy, France, West Germany, Belgium, England, Japan, and Canada.

The Machine Tool Exposition—1960 and the Production Engineering Show will have a 10-day run starting Tuesday, September 6, and closing on Friday, September 16. The Coliseum show will run for eight days starting on Wednesday, September 7, and closing on Thursday, September 15. All three shows will be open Saturday and closed Sunday.

Showgoers' guide

Indispensable booklet for prospective visitors to the Machine Tool Exposition is NMTBA's Visitors' Information Booklet, giving full information on show hours, transportation, hotel rooms (they're going fast) and the new Inquiry Time Saver Plate. Circle No. 50 on the Reader Service Card in this issue, or write directly to the National Machine Tool Builders Assn, 2139 Wisconsin Ave, Washington 7, D C.

Teflon-and-steel die forms superalloys

Thin high-strength titanium and stainless steel alloys are being formed with a universal steel box and a shaped teflon die at Chance Vought Aircraft's Aeronautics Division, Dallas—and the job is being done at about a third less cost than with conventional forming methods.

The part is laid in the box, is indexed by pins, and is formed by a steel punch with pressures as high as 18000 psi. Limited runs have been made with no deterioration of the teflon insert.

Similar to rubber forming

Chance Vought's process, which is similar to rubber forming, is an offshoot of experiments in handling of PH-15-7MO stainless steel parts for supersonic aircraft and space vehicles.

Because of the close tolerances required for parts, particularly those for use in honeycomb brazing assemblies, the company found it impossible to use regular rubber press techniques for forming the light-gage metals. (Rubber flows at pressures far below those required to form parts to 0.002-inch tolerances without springback).

Flows like rubber

With the Chance Vought method, the teflon yields and flows, much as rubber does, and acts as a matched die, while the surrounding steel box acts as a trap for the material. Variations of part configurations—both constant-thickness gages and tapered gages—can be formed with the same box, merely by changing the punch and the teflon insert.

The steel punch die fits snugly to the sides of the steel box, and the female die does not require coping or close fitting to mate.

Cutting teflon to shape

The teflon is cut to approximate shape, and under sufficient pressure, flows and reacts in a manner similar to that of a matched die set. And because an exactly matched punch and female die set are not required, savings in tool fabrication time have amounted to about one-third.

Works two ways

The technique works eithers with impact presses or under hydraulic pressure—is actually much like a straight coining operation.

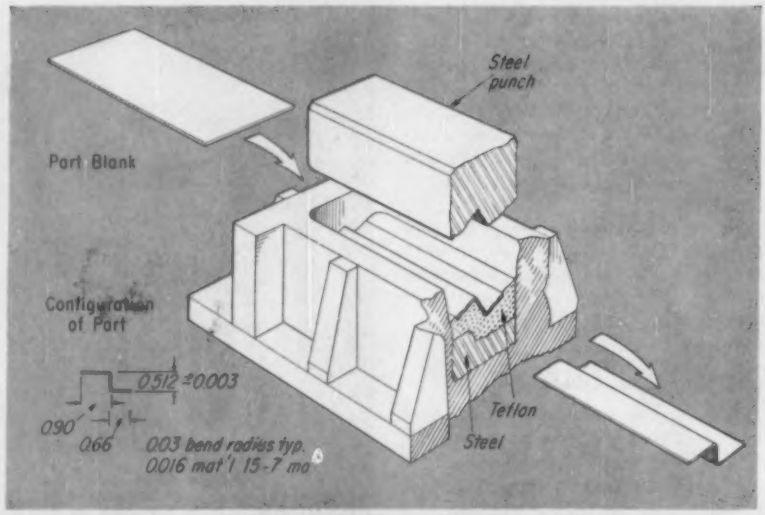
All work done so far at Chance Vought has been of the cold variety. Normal safety precautions are used in machining the teflon insert—to prevent spreading of dust or chips—because the material is dangerous when reduced to a gaseous stage by high temperatures.

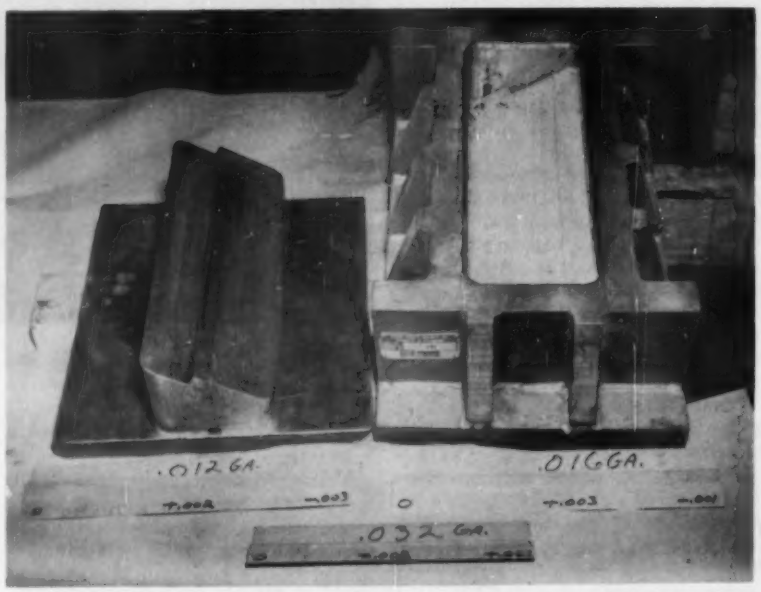
Using a 1000-ton hydraulic press, Chance Vought was able to form parts at 5300 psi from flat blank, which was then reversed and hit again.

Height of the web on the formed part was held within 0.001 in.; flange bevel was 1 in. open.

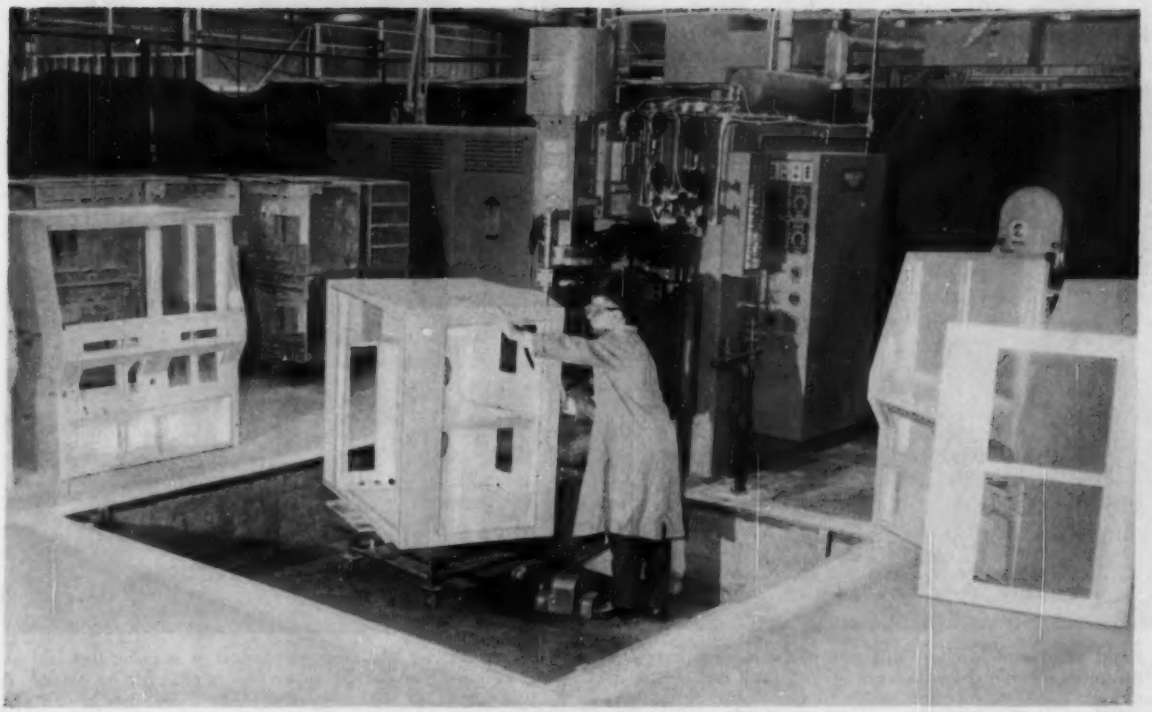
Summed up, the advantage of Chance Vought's teflon-and-steel die process are:

- Elimination of die matching and the need for guide pins.
- Multiple usage. (Die holder is universal, die and punch inserts are interchangeable.)
- It can be run either on a press brake or a punchpress.
- It will not mark or coin flanges.





Cutaway (top) and actual (bottom) views of Chance Vought's shaped teflon insert and universal steel box



Hydraulic lift puts work at the right height, gives greater floor-to-horn clearance for large aluminum cabinets

Flexible tooling and careful advance planning can...

Put quality into your spotwelds!

By W W Hurd, manufacturing engineer,
Electronics Division, Westinghouse Electric Corp, Baltimore

A job shop has to be ready for just about any work that comes along. Further, if it manufactures electronic equipment for the military services, as ours does, it has to meet rigid specifications and tolerances on a wide variety of sizes and shapes.

Among the smaller items produced in our spotwelding shop are small chassis with many intricate weldments. At the other end of the scale, are large cabinets and consoles made from formed or extruded members with a sheet metal cover. About 90% of the work is in ⅛-in.-thick aluminum, and the rest varies from 0.032 to 0.250 in.

In order to handle this variety of work economically and still maintain high quality, we have had to develop some of our own tooling and procedures. Flexible tooling widens our capabilities, and well-planned procedures increase our control over the spotwelding operations.

One of our most successful ideas for greater flexibility and efficiency is a hydraulic lift that lowers a whole section of floor in front of the spotwelding machine. With this, the assembly being welded can be positioned at the most convenient working height.

The hydraulic lift is especially valuable for large cabinets, because it allows greater clearance between the lower horn and the floor. Previously, we had to hold the large cabinets on top of the lower arm (if practical) and balance them in this position for welding.

Now, we can hang such cabinets over the lower arm, and in some cases, one man can handle cabinets that formerly required two. Further, certain designs are now possible that could not be spotwelded without the hydraulic platform lift.

Another tool that gives us greater flexibility and at the same time improves quality is a special arm and offset holder. Standard commericial offset holders, even the heavy-duty type, cannot stand up to the high pressures we must use to produce quality spotwelds in the thicker gages of aluminum—up to ⅛ in. thick.

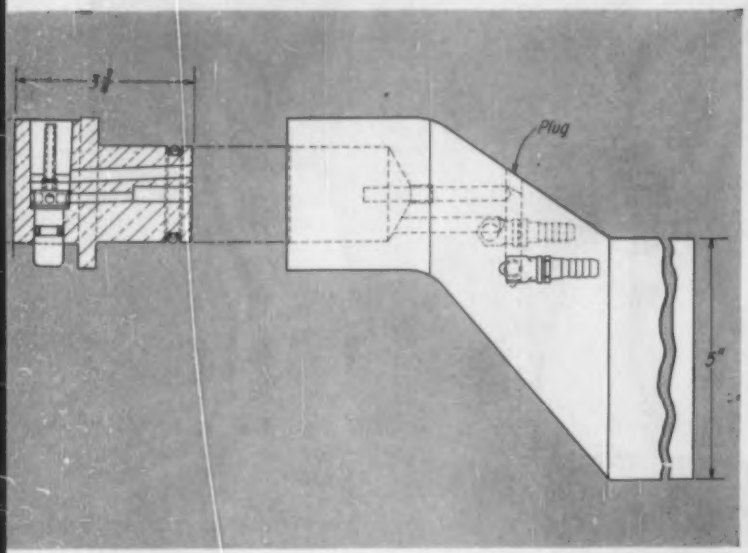
The holders deflect, and the deflection changes the location of the spotweld tips in relation to one another, causing the workpieces to slip. This slippage cannot be permitted where close tolerances must be maintained.

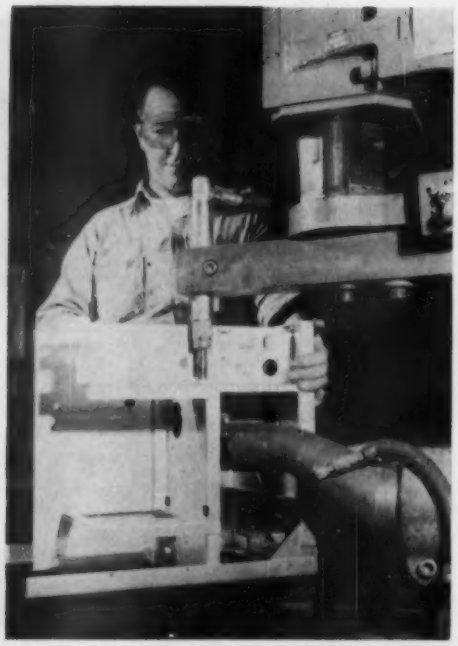
Therefore, we designed a special arm which combined the arm and offset holder in one. This eliminated the joints and small-diameter shanks where most of the flexing occurred.

Even with its taper (from 5 in. to 3 in.), this special arm is rigid enough for virtually all spotwelding. In addition, it permits us to spotweld in areas that formerly were not accessible with any other setup.

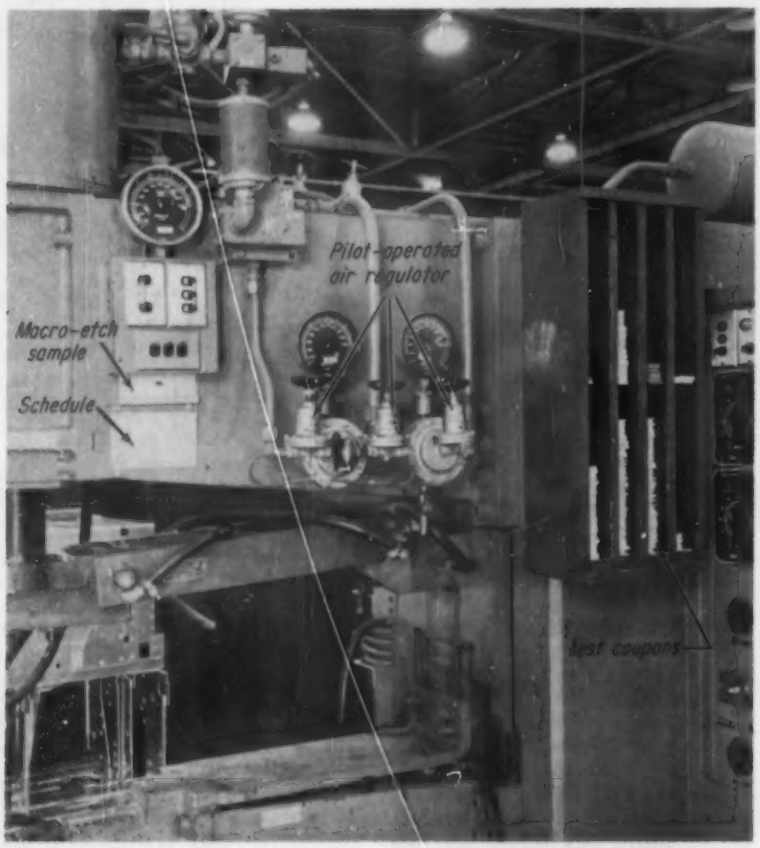
Before developing this arm, we used to change arms and electrode holders constantly, to avoid using the conventional offset holder except when absolutely essential. Whenever we could—on any weldment that was

Put quality into your spotwelds . . .





Rigid offset arm reaches "difficult" spots and supports high tip forces without deflecting, can operate with different adapters for special jobs. Shop-developed, it is being installed on all welders. Swivel-type upper arm is patented by Sciaky



Everything is handy on this spotwelder. Special rack displays schedule cards and latest macro-etch sample another rack holds 5 x 1-in. coupons for tests; and the pilot-operated air regulator maintains precise control over pressure

freely accessible from both sides—we used a 5-in. arm and straight electrode holders and tips.

With the new adapter arm, we have all the advantages of the straight arm and the added feature of accessibility all in one. It gives us less displacement of parts, better welds, and good appearance, and, as the machine settings are less critical, it also reduces setup time. In fact, it has saved so much time that we are installing the device on all our welders as fast as practical.

Another item of equipment that helps us produce high-quality spotwelds is the pilot-operated air regulator. All of our machines are equipped with these, because precise regulation without pressure build-up or drop is mandatory for consistent spotwelding in aluminum.

In a low-resistivity material such as aluminum, the tip force has a great influence on total weld heat—even greater than that of weld-time and current settings. This force, in fact, determines the nugget structure and the presence or absence of porosity, voids and expulsion.

However, in spite of the advances made in electronic controls in recent years, the air-regulation systems have not generally kept pace. Pilot-operated regulators, though, give a quick, clean response to adjustment. More important, they maintain better pressure regulation than previous types.

We have also improved our con-

trol over the welding operations by setting up a program to make sure that tips of the correct class and radius are employed for each welding job. Special tools dress the tips to the desired radius, both in the spotwelder and in the machine shop.

At the spotwelders, the operators use special paddle-type dressers that have radiused surfaces covered with a fine abrasive cloth. These dressers will not only maintain the radius, but will also dress a tip to the proper radius.

With the tip-dress paddle between the electrodes, the operator lets the electrodes press against the cloth-covered surfaces. Normally, the pressure is determined by the weight of the upper arm and holders. However, on all machines, this pressure was too high, especially on the swivel-type machine which has a heavier upper-horn casting.

To overcome this, we equipped all of the spotwelders with an auxiliary circuit that returns a small amount of air to the lower cell of the cylinder (diaphragm) during tip dressing. This reduces the weight on the tips to any desired force

In the machine shop, the tips are finished to the desired radius on a lathe, drillpress, or mill with specially ground cutters and holders. They are then color coded and placed in racks where they are displayed for easy selection. The radius, type of tip, tip material, and holders are specified on the schedule card for each spotwelding job.

Color coding also helps us maintain control over the schedule cards. Cards for each machine are of a specific color so a welder will not be set up according to a schedule that doesn't belong to it. Cards for the master file and for tentative schedules are also identified by special colors.

Attached to each spotwelder is a card file containing schedules established for all the various combinations of material welded on that machine. On the other side of the machine, at the right-front, is a special rack that will hold one schedule card and one macro-etch test sample.

During the operation, the schedule card for the setup and the latest macro-etch sample (required every four hours) are displayed in this special rack. Here the section supervisor and the inspector can easily check the card and the actual settings on the machine to verify that the work is being performed according to specifications.

Backup paperwork and job record cards are numbered to correspond with the schedule cards and are filed away. Thus, if at any time a spotweld is in doubt, it is possible to go back and check the conditions under which the weld was made.

All of the features described above fall into the categories of innovations, or unusual applications of standard equipment, or items developed to satisfy a need. They were developed by manufacturing engineers working in close coordination with design engineers, military quality control representatives, Westinghouse quality control personnel, and resistance welding equipment suppliers.

Machining 'hot' jobs by remote control

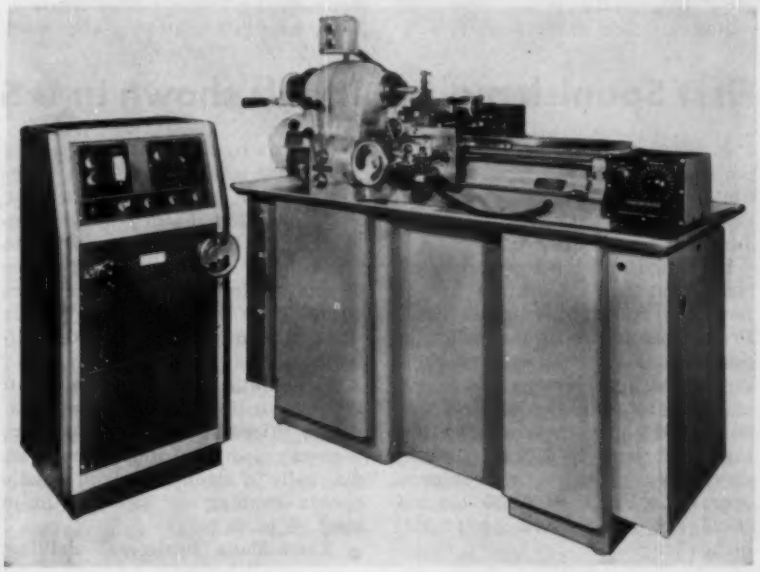
Standing safely at his remote control station, the operator of this small tool room lathe is protected from the radioactive materials that he machines. He controls both longitudinal and cross feed motions from the console of a complete two-axis servo system; however, other operations—such as loading work, closing collet, and changing tools—are done by manipulators.

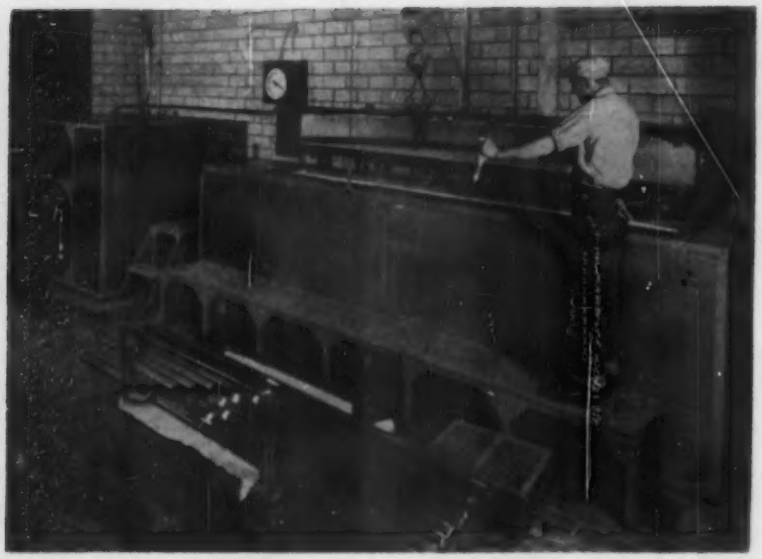
The console not only has carriage and cross feed handwheels (identical to the lathe handwheels) but also has spindle speed and direction control, indicator, carriage longitudinal feed speed and direction control, and necessary transfer switches. It even includes a key lock switch for selection of direct or console control.

This system, developed by United Control Systems of Dayton, Ohio, is installed at the High Level Radiation Branch of the Air Force Nuclear Engineering Test Facility at WADD, Wright-Patterson AFB, Dayton.

In addition to its remote control unit, the lathe also has all standard operational controls. Therefore, the operator can work directly at the machine, when conditions allow it, as well as at the remote control station. In either case, the handwheels of one control unit follow the other—thus the operator can shift from one control position to the other at any time with the certainty that no inadvertent motion of carriage will occur.

Longitudinal and cross feed position readout are transmitted with a rack and gear drive to rotary pots, and cross feed drive is a DC motor actuator assembly coupled directly to the cross feed screw. Both manual and motorized feed can be accomplished at the console.





Cold-treating stabilizes lathe ways

Cold treating at —150 F is applied to all of The American Tool Works Company's engine-lathe and positioning-table ways. Treatment for eight hours provides complete transformation of all free austenite to martensite. This rapid ageing process virtually eliminates the danger of future warping and offers a number of secondary benefits. For instance, cold treatment also adds a couple of points of hardness. After the quench which follows flame hardening, ways normally have a hardness of R_c 60-62; cold treating them increases this hardness by about two points.

Material used in the ways is Timken graphitic tool steel, cold drawn to plus 1/32 in. of final size on all surfaces. This steel is rolled, annealed, pickled and finally cold-drawn at the Timken plant. Graphitic tool steel is used because the free graphite flakes it contains act as tiny lubricators to produce a tremendous amount of wear resistance over and above that of other tool steels having the same hardness.

Prior to the cold treatment, the top surface of the way is flame hardened approximately 3/16 in. deep. Because engineers at American know the cold treatment will bow the way, it is mechanically bowed before treating. Thus, when straightening after cold treating, the way is never bowed so much that the hardened top surface is put in tension rather than compression. Tension in the hardened way could cause cracking.

Cold treating is accomplished in a Weber refrigerator, which uses three compressors to take the temperature down to —150 F. This refrigerator can accept lengths up to ten feet—and that is the length at which all ways start out.

Here is the procedure for manufacturing ways:

1. Receive 10-ft lengths of graphitic tool steel as described earlier.
2. Flame harden top surface of way.
3. Pre-bow on Oil Gear press.
4. Etch each way with acid to determine depth of hardness and check surface hardness with Rockwell hardness tester.
5. Cold treat for eight hours at —150 F.
6. Stress relieve in oil at 400 F for 12 hours.
7. Straighten on hydraulic press to within 0.012 in. for twist and straightness.
8. Inspect with Magnaglo for cracks or checks.
9. Fixture and rough grind on Madison surface grinders.
10. Fixture and finish grind within 0.0002 in. total tolerance.
11. Reinspect with Magnaglo for checks and cracks; measure hardness all over.
12. Cut to length with abrasive cut-off wheel.
13. Precision plane keyway on soft underside of vee.
14. Drill and tap holes in keyway for hold-down bolts—four inches apart.
15. Precision grind end of way for squareness.

First Spanish machine tools shown in U S

For the first time, Spanish machine tools were displayed in the United States, at the Spanish Pavilion at Chicago's International Trade Fair, June 20 through July 5.

Exhibited under a cooperative arrangement, these machines are offered for export to the United States. Prices mentioned in the following descriptions are FOB factory.

- Danobat's universal grinding machine has a 15¾-in.-wide wheel driven by a 5.5-hp motor for OD grinding, and an 18,000-rpm spindle driven by a 1.1-hp motor for internal operations. Priced at $3530, the machine can grind shafts up to 31½ inches long.
- Berdin's hydraulic tracer copying lathe turns small-and-medium diameter pieces at relatively high speeds. Priced at $2250, it will take work up to 21-21/32 inches long, and up to 7⅞ inches OD. Hydrocopying device is said to follow templet contours within 0.00079 in., and will handle work within 4-23/32 diameter difference.
- Ciclo-Matic bench-type, automatic-cycle drilling and tapping machines, priced at $298 and $408, were demonstrated. Drill unit takes ⅝ in. dia drills in steel, has eight spindle speeds. Tapping unit taps 5/16 in. in steel, ½ in. in brass.
- Rosca-Matic horizontal drilling, threading and tapping machine is for small work held in collets or fixtures on a small vertical table, has six spindle speeds from 300 to 2400 rpm, and capacity for ⅜-in. taps in steel. Price: $495.
- Aikartu's automatic rise-and-fall miller has an 11 x 37½ in. table, uses any of three spindle drives, has speeds from 27 to 1065 rpm. Price: $2470.
- Zayer's No. 4 universal miller is equipped with a 350 x 1500-mm table, has 18 spindle speeds from 24 to 800 rpm. Price: $4043.

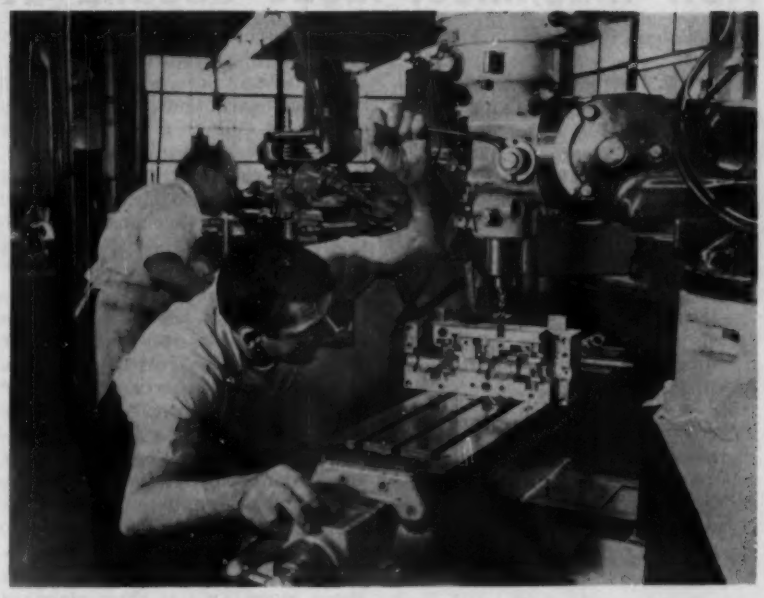
Metalexport of Poland showed eight machines. At the 1959 Fair, the Poles booked $250,000 in orders.

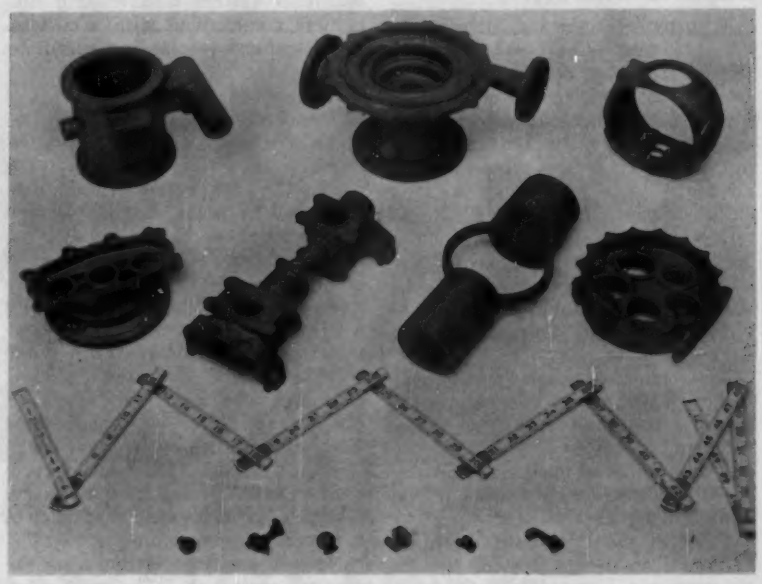
Tooling precision into BIG investment castings

Small investment castings aren't unusual. Big investment castings aren't unusual. But big *intricate* investment castings are something out of the ordinary — and that is just what Arwood Corp is producing at its Groton, Conn, ferrous foundry: intricately cored and contoured castings weighing as much as 100 pounds.

It's done by ceramic shell molding, one of three investment casting processes. Method can turn out either clusters of small castings or large intricate castings. Arwood has concentrated on the latter, developing tooling methods for large single-cavity molds. In the last eight years, the firm has progressed from small castings to ones 2 or 3 feet in overall dimensions.

Such successful ceramic shell molding depends upon the accuracy of the wax pattern, which in turn depends upon the accuracy of the basic metal pattern. This is made from carbon-steel screw stock or magnesium, and incorporates shrink allowances.





An accurate wax-injection die such as this one produced at Arwood Corp's Groton, Conn, toolroom (top photo) is the second vital step in the production of large investment castings of intricate contours such as those shown in bottom photo

Complex wax dies

The wax-injection die is made by casting each half of a simple die (of low-melting-point alloy) to the metal pattern. These dies are sometimes multi - sectioned, to accommodate changes in the parting line, or to permit withdrawal or release of an undercut section in the wax pattern. Die sections are then assembled with dowels and clamps.

Next, blended wax is fed at 150 F and 100 psi from an accumulator and pipeline system to Arwood-built wax injection presses. Some of these wax patterns require coring. The cores are made of a water-soluble wax and are held in the die by arbors.

When the wax solidifies, the pattern is stripped by dismantling the die. Cores are washed out. Then gates, sprues, and support elements are assembled to the pattern by wax welding. Most of this "furniture" is standardized, and is produced by wax dies or by extrusion presses.

The ceramic shell is built up to ¼ in. thickness by dipping it several times in different slurries, and by riddling it with ceramic frits or sands. After drying 24 hours in a temperature - humidity controlled room, the shell mold is dewaxed by oven heating at 400 F.

The molten wax drops through the open furnace bottom onto blocks of dry ice, which quenches the fire. The dewaxed shells are then baked at 1600 F for a half-hour, and are stored or cast as required. All stored shells are preheated to 1200-1700 F (depending upon the alloy to be cast) before pouring.

At the moment, Arwood is pouring from 50-lb ladles, supplied by 100-lb induction furnaces. But electric-arc furnaces are being installed to increase the pour.

When the casting has cooled, the ceramic shell is broken off by vibration, and the casting is cleaned by shotblasting.

CABLE FROM LONDON

New machines, ideas abound at Olympia

By Burnham Finney, editor

LONDON, June 29—The British Machine Tool Show at Olympia is a very good, highly rewarding show. It contains a surprising number of important innovations, especially since it comes only nine months after the European Show at Paris last September.

It is the largest of the series of shows that the British Machine Tool Trades Association has been sponsoring every four years. About 1400 machine tools from 12 countries are on display—around 40% of them from outside the United Kingdom.

With the usual British flair for showmanship, the show was opened on the preview day, June 24, by the president of the British Board of Trade. Four days later, Prince Philip made an extensive tour of the exhibits.

Magnet for world buyers

Even more important, Olympia is proving a magnet for large and small buyers from far places, as well as from the UK and the Continent. Most top officials of General Motors Overseas are here, and other influential automotive customers are represented, too.

The Russians have sent a delegation to Olympia, just as they did in 1956. A team of 26 Japanese industrialists are taking a close look at this International Machine Tool Exhibition, the official name of the Olympia Show.

American participation in Olympia is far bigger than ever before. At least 68 machines of U S manufacture are on display. Beyond that are a large number of machines made by U S subsidiary companies in the United Kingdom.

Some of the U K-built machines of American design are the first to be produced here. A sizeable percentage of the components for some of these machines are being supplied from the States.

Electronic controls of one kind or another are prominently on display, though it would be a gross exaggeration to say that numerical control is anywhere near as prevalent as it will be at the Machine Tool Exposition in Chicago in September.

Most major British builders are showing machines with automatic control. What's more, customers are reported more interested than ever before in these controls.

Control units are being furnished, with few exceptions, by electronic companies. Only in a few cases have builders developed their own control units. One prominent electronics firm reports that its sales of control equipment for machine tools have doubled in the past year.

Automatic tool changing

Automatic tool changing is on display at Olympia, just as it was in Paris last year. This time it is a feature of a large Archdale (British) tape-controlled vertical drilling machine. This machine has constant-flow fluid slideway bearings and a Staveley-developed coordinate measuring and positioning system, incorporated with automatic tool change.

Automatic work handling is featured more than ever. Applications show ingenuity . . . four standard machines (lathes and milling machines) are coupled with a custom-made transfer system and automatic loading, for example.

Aside from speeding the cutting of metal and from getting work into and out of the machine faster, builders are concentrating on reducing the setup time between jobs. This trend is as evident at Olympia as it is in America.

Several British subsidiaries of U S builders are starting to make machines (on display at Olympia) which will not be produced in the U S. Examples: Cincinnati 207-12 and 307-12 dial-type Model ELR milling machines; Cincinnati 520-20, 540-20, 620-20 and 640-20 dial-type Model ELA milling machines; Kearney & Trecker's Model 1218 bedtype production milling machines; Brown & Sharpe's ½-inch-capacity Model A turret drilling machine.

Newall (British) is featuring numerical control in a big way—offering control systems by four or more electronic control makers. Newest Newall machine is an automatic tap grinder with automatic loading, sizing and relieving. Floor-to-floor time on ¼-inch tap is 20 seconds.

A David Brown hobbing machine incorporates a corrector system which frees pitch accuracy from dependence upon the machine's master gear. This system uses the moire fringe technique in conjunction with a phase reader and a new control unit for continuous and automatic correction in relative motions of the hob spindle and table.

A tape-controlled EMI-Grinston (British) light drilling machine is equipped with automatically programmed seven-position turret head. It is priced under $6000.

Featured on a vertical boring machine is the prototype of a radial cylinder hydrostatic transmission system, which maintains constant cutting speed over any change in work diameter. This model was designed by the National Engineering Laboratories at East Kilbride.

Threading innovations

Threading developments include a new approach to pitch correction when cutting leadscrews by a thread-whirling method. A curve of the errors measured on the first pass of the thread-whirler head, or on the first screw cut, is plotted on a large-scale chart behind the machine, in white tape. A light-sensitive cell on the cutting head follows the tape line and feeds a positional signal to a slave motor at the end of the master leadscrew, which moves the master screw the necessary amount to correct the pitch error.

Drummond-Asquith has in action a 14-station inline transfer machine for cylinder and crankcase cam, crankshaft and distributor bores of small cylinder blocks. It is the only inline transfer machine at Olympia. There were none at Paris in September because of restrictions on exhibitors' space.

SIP is showing a coordinate spark erosion machine with an Agietron head. Table travel is 8 x 8 inches, and metal removal rate is 300 cu mm/min. Several other spark erosion machines are also on display, including an Elox.

Higher cutting speeds

Trend to higher cutting speeds continues, especially on high-speed spindles for machines. Shown for the first time anywhere is the Ashcombe AiRotor (*AM*—June 15 '59 p2), an adaptation of a dentist's drill, with operating speeds of 300,000 rpm. It is very small and can be used as a hand tool or adapted to milling machines, jig borers, lathes and pantographs. It is employed to machine hard surfaces.

Alfred Herbert is offering a No. 2D capstan lathe with an auto-robot system that automatically controls every movement, including the chuck. This machine is for fully automatic, high-production, repetitive bar work up to 1½ inches in diameter. It is suitable where small batch quantities do not justify multi-spindle automatics.

Gleason has on display a new machine (a No. 15 blank checker) for checking bevel and hypoid gear blanks, both before and after the teeth are cut.

Gisholt is showing for the first time anywhere a 5AR automatic capstan-type turret lathe with bar stock capacity of 2½ x 4½ inches, which requires no more time for setup than a hand-operated machine. Change-over from bar to chucking work takes less than one hour, making this new machine especially useful on small lots.

BSA has a drill-pointing machine with motorized grinding spindle, carrying a straight cup grinding wheel. Drill to be sharpened is mounted on an adjustable drill holder with tungsten carbide locating faces. It reciprocates in a straight line with the drill point flank passing across the inside edge of the grinding wheel.

Larger and more versatile British and Continental machines are in evidence. Wickman has a four-wheel grinder which automatically goes through a five-operation cycle to produce finished parts. Wheel dressing is automatic.

Electrolytic grinding is being introduced into the U K in the Eleform machine for work on carbides and other alloys hard to machine by conventional methods.

MicroMat jig borer, developed in cooperation with Carl Zeiss, is one of the East German machines at the Show. Its optical measuring system uses illuminated graduated drums for coarse adjustment. Fine settings to 0.00004 in. are made by microscopes, through which the slide travel is indicated by a glass rule and reversing collimator.

Charles Churchill is introducing a new range of gear shaving machines —two of the models being shown for the first time. One is an 8-inch semi-automatic with micro-positive auto-electric knee-and-table operation and hydraulically run automatic tailstock. The second is fully automatic, fitted with automatic loading and conveyor equipment.

Heller is showing its six-spindle automatic-turret drilling machine—first introduced at Paris last September.

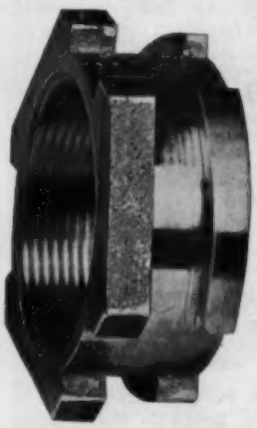
Asquith has on display its first British-made Warner & Swasey Asquith 2AC chucking automatic and a 10-inch Gould & Eberhardt Asquith gear hobbing machine.

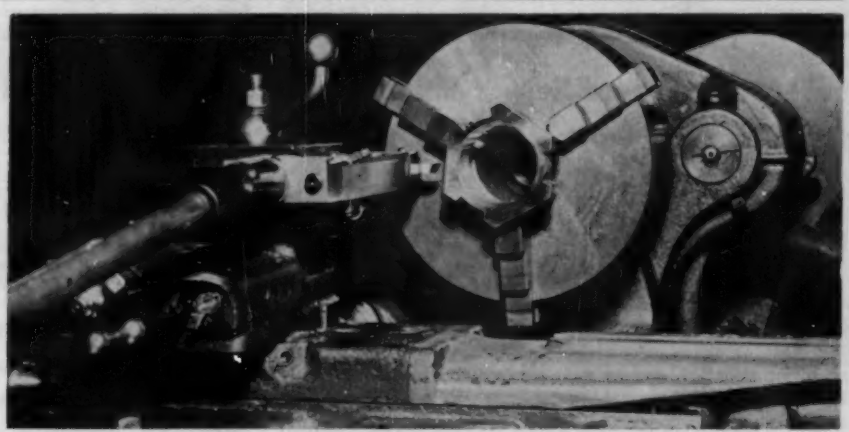
Landis Lund is grinding a four-cylinder automobile crankshaft on an automatic crankpin grinder.

Kearney & Trecker-CVA Ltd has on display the MilwaukeeMatic, which is to be built only at Milwaukee and not in England.

Alfred Herbert Ltd is showing a large tracer-controlled Keller B-G milling machine produced at Herbert's Coventry plant.

LaPointe is demonstrating an automated horizontal hydraulic broaching machine with a special fixture for surface broaching. The machine and fixtures were designed and built by LaPointe's British company for an automative customer.





Wedge-shaped lobes (above) lock fittings to interlocking lobes in other pipe fittings. Cammed tool cuts contours as it moves sideways on toolblock, then snaps back to start position as a space between lobes passes. Driveshaft runs from leadscrew

Cam cutter shapes LOX fittings

Simple shuttle-bar tooling on an engine lathe cuts cam shapes on couplings for liquid-oxygen lines—and keeps costs low enough even on short runs. Newark Controls, Inc, Bloomfield, N J, rigged the device to cut three wedge-shaped lobes on each hose fitting.

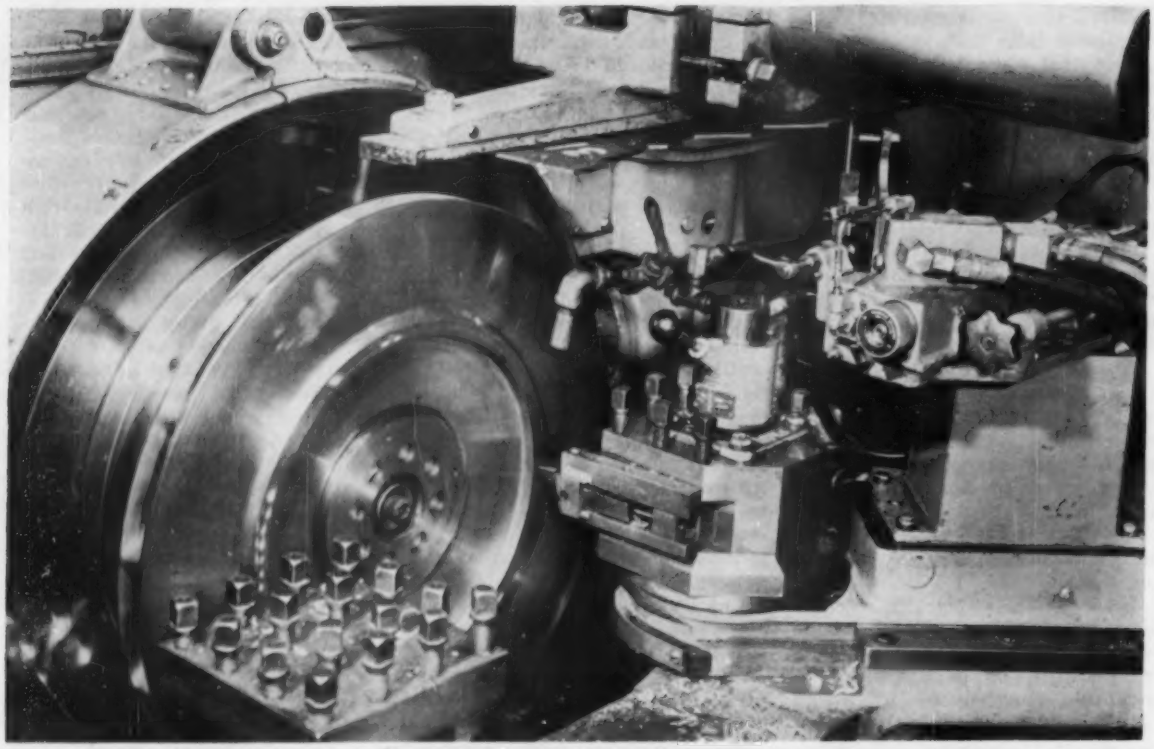
Lot sizes are only 10 to 50 pieces, but fortunately there are several coupling sizes—for lines from 1 to 4 in.—and all have the same taper on the lobes. Between lots of different size and repeat orders, the tooling can be kept busy; and it can be removed from the lathe when necessary.

Carbide-tipped tool

The carbide-tipped tool is mounted on a shuttle-bar toolholder with spring return, and is actuated by a single-lobe cam driven at three times the lathe spindle speed.

A chain and sprocket connect the telescopic countershaft to the lathe leadscrew, with drive through two universal joints; all mounted in inexpensive ball bearings. The highest leadscrew speed is 1.5 times the spindle speed, and a 2:1 ratio in the sprocket brings countershaft speed up to three times spindle speed.

The cam, located inside the shuttle-bar housing, has 300° uniform rise and 30° quick return.



Contouring turret lathe tracer unit is mounted at rear of cross-slide. Templet is clamped above slide, easily reached for setup. Spindle rotation is reversed except when facing in front of centerline. Work is a turbocharger impellor

Lathes at three different manufacturing companies, cutting three kinds of workpieces, illustrate . . .

Three ways to make contouring pay off

"The poor man's numerical control" is one way to describe contour tracing. But at the same time this description short-changes a well-established manufacturing technique that can achieve sharp savings on bread-and-butter machining jobs because of its advantages over conventional machining: faster tool cycles, quicker setup, and greater accuracy on repeated operations.

How well contouring can pay off is illustrated by case histories from three plants, each of which specializes in a different type of contouring: Elliott Co, division of Carrier Corp, Jeanette, Pa (disks); Vaughn Machinery Co, Cuyahoga Falls, Ohio (cylinders); and Spencer Mfg Co, Spencer, Ohio (shafts).

Elliott Co, for example, machines turbocharger disks, casings, and impellers. Most of the work is large-diameter aluminum in lot sizes from 10 to 60 pieces.

This is turret-lathe contour tracing, on a Warner & Swasey 4A that has a contouring hydraulic-power cross-slide installed in 1957. The machine is now so loaded with work that a second unit, a 5A, has been ordered with the same kind of tracing equipment, even though this combination is special.

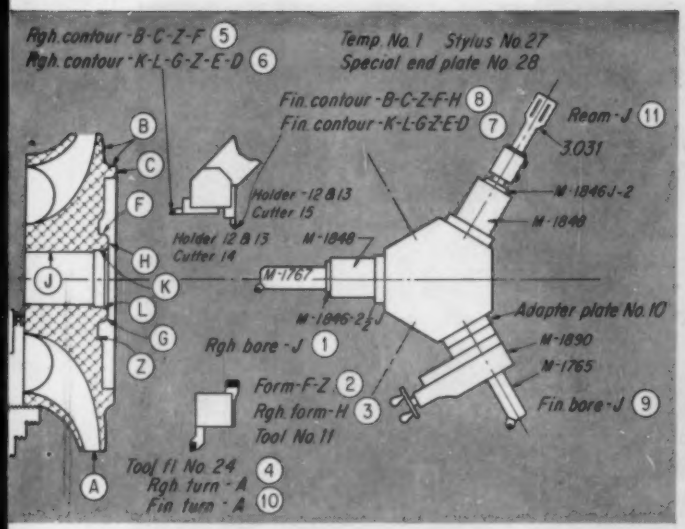
A typical job is a 22½-in. aluminum impeller to be roughed and finlished to $\frac{+0.001}{-0.000}$ in. at speeds up to 1000 fpm. The roughing cut is ¼ in. deep with feed at 0.014 ipr; finishing is 0.020 in. deep at 0.008 ipr to 0.011 ipr. The carbide tool is guided by a cross-slide hydraulic tracer to finish the part in 45 minutes. This compares to machining time as long as 6 hours on an older VTL setup.

This amount of time saving is perhaps extreme, but cast-iron casings are being contour machined at a similar setup with savings of one-third. Steel rotor shafts are cut with 50% time savings.

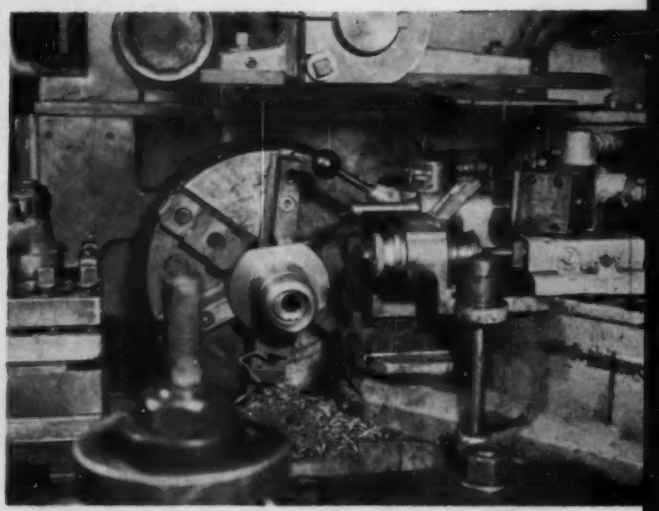
Contouring advantages

There are savings other than in time, as well. Probably the greatest single advantage of a turret-lathe contour tracer is simplicity. Only one templet and a few simple tools must be designed and built for jobs that would otherwise need extensive methods planning, special tools, and a complex setup. Human error is largely eliminated, and repetitive accuracy is greatly improved over other machining techniques. Tool storage is easier, and all kinds of records and paperwork can be reduced.

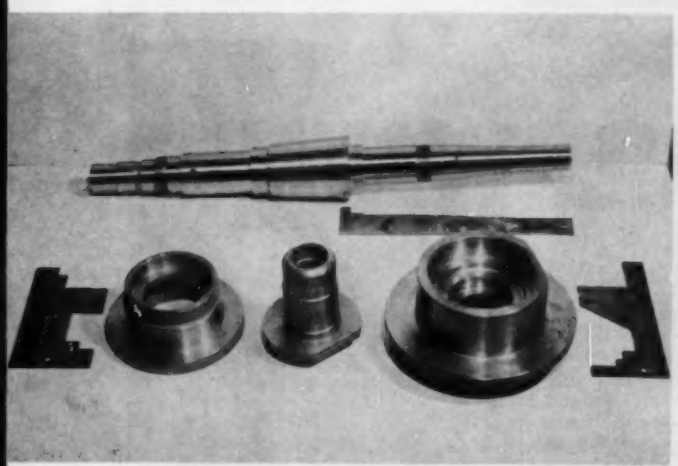
How often can a job be routed to the contour tracer? Superintendent Ross Bushyager and manufacturing engineer George Brinker at Elliott agree that any part with face operations requiring more than two tools



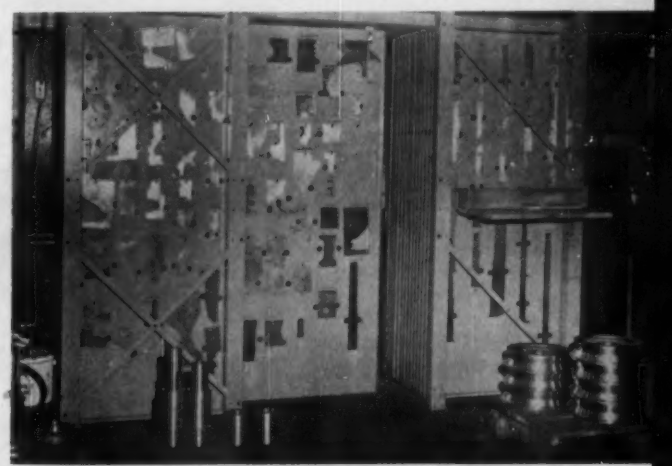
Aluminum turbocharger impeller (see photo, p114) is contoured by tools on cross-slide, with boring and reaming handled by turret tools. Time is 24 minutes for cycle. Impeller fits diesel engine



Capstan-shaft housing for "Ring Blox" wire-drawing machine is contoured in 7 minutes (outside). Rear slide works from templet mounted flat over it. Total contouring time for inside and outside surface is 22 minutes, 1/3 usual time



Typical contouring jobs — with templets — are slated for the turret lathe. Contouring saves around $7.50 per block; and on larger blocks machined at a vertical boring mill, contouring may save $35.00



Templet storage takes minimum space in metal racks. This is practically all the space required for tooling, because most turning tools are simple shapes, made from stock tools, readily available from tool crib

can be handled economically on the tracer.

Most of the large-diameter work is contour facing. If the depth of contour should exceed the stroke of the hydraulic cylinder, the operator backs off the slide, moves the apron over one position on the stop roll, and picks up the contour again, gaining another full cylinder stroke. The shift takes only a few seconds, and the cuts blend almost imperceptibly.

Overall tooling costs are often cut to as little as 5% of what might normally be expected. A precision flat templet costs from $50 to $100, where special cams for a mechanical contouring device applied earlier cost as much as $1500. Now the shop needs only a roughing and a finishing tool, plus a few simple extra tools for the supplementary operations performed from the turrets.

Cylinders and castings

Even smaller lot sizes can be contoured economically. Vaughn Machinery Co, Cuyahoga Falls, Ohio, turns drums and capstans for wire-drawing machines on turret lathes, a progressive step turner, engine lathes, and boring mills (for largest sizes). The finished machines are produced practically on a custom basis, and lots range from 1 to 30 pieces.

Vaughn proves that the templet contouring system will handle heavy cuts because parts are roughed and finished; Gordon Vaughn, VP manufacturing, says the contouring equipment will handle any cut the basic machines will handle.

Advantages for contouring are similar to those at Elliott Co. Setup time is so short that any job requiring an angle or surface that would

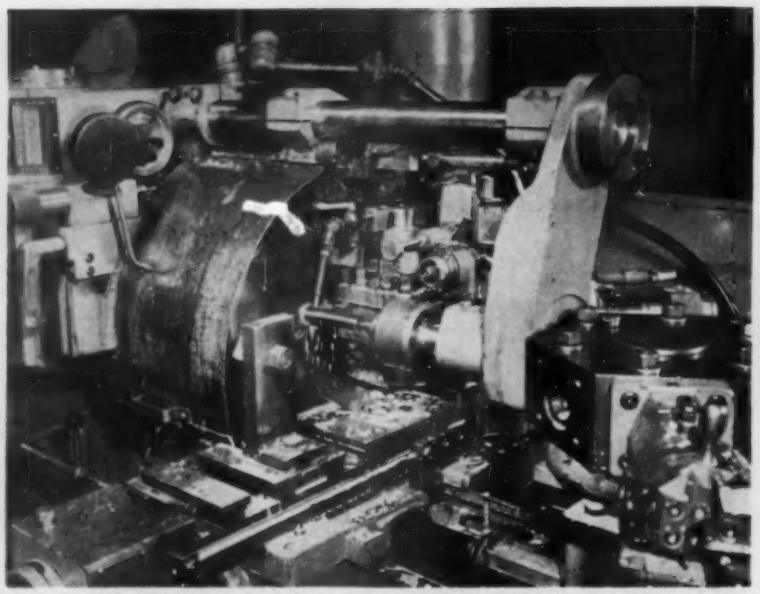
have to be cut with a form tool can be contoured. Tool cost is low—from $25 to $50—and templet storage is particularly simple because of a rack system where templets are filed by part number. Tool design and reconditioning are equally simple and inexpensive, and checking and gaging are easy.

Another advantage is not immediately apparent. Some of the parts machined by form tools must be polished to remove scratch marks, and this polishing has taken, in some cases, as much time as machining. With the contouring tools, say Vaughn personnel, polishing can be eliminated because single-point contouring tools produce a better finish than form tools.

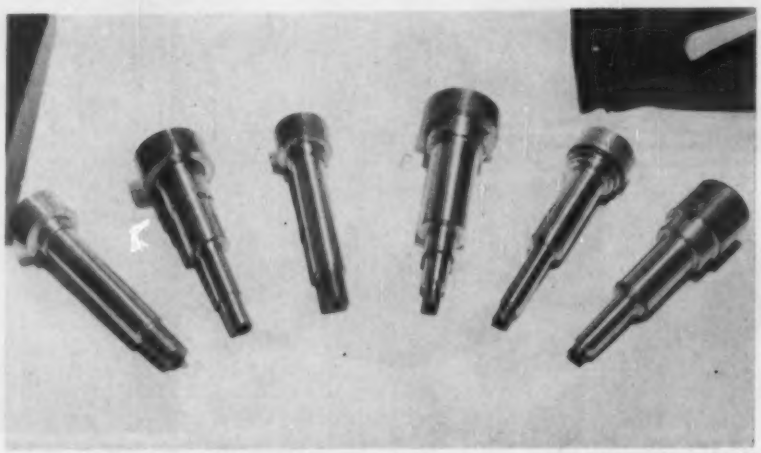
On a No. 5 W & S turret lathe, a capstan shaft housing has been contoured to reduce machining time on the OD as much as 66%. Other cast blocks have been reduced in cost as much as $35.00 apiece. Pointer rolls, which have several precision grooves around the OD, have been form-cut on turret lathes in 5½ to 6 hours. A newer method on a contouring turret lathe takes 45 min.

Repetitive accuracy is such that the operator now only has to check the diameter of one groove to find out how much the cutting tool has worn. The bores and OD's of the rolls are later ground, but the grooves are left as turned.

For some small shaft work with up to five straight diameters, Vaughn uses a purely mechanical tool, with no templates or hydraulic power. This tool, a progressive step turner on a ram turret lathe, now cuts three diameters automatically in succession on capstan shafts to 0.005 in. pre-grind tolerance. Total machining time is 8 minutes. Before this new step-turning method was applied, the job required 75 minutes. This job is handled in lots of 60 to 100 pieces, but a lot as small as 6 can be processed economically.



Trailer axle is rough-contoured from rear cross-slide, guided by cylindrical templet overhead. Swing stop on front slide locates work. Centerdrilling and threading are handled by tools from turret



Contouring templets for axles are mounted between centers to guide tool on several diameters, radii, and faces

Trailer axles

One man at one contouring machine does the work that required five men at five setups before the new equipment was installed at Spencer Mfg Co, Spencer, Ohio. Because of this increase in productivity, the plant expects to pay off a No. 5 Warner & Swasey turret lathe with hydraulic cross-slide contouring attachment in 10 months.

The machine now runs three shifts, machining both ends of a number of different axle shapes in several grades of steel. These are controlled by circular templets that guide the machine on diameters, radii, chamfers, steps, and faces. The pictured job is a utility-trailer axle for which 1¼-in. hot-rolled square stock is fed through the machine spindle to a stop on the front of the slide.

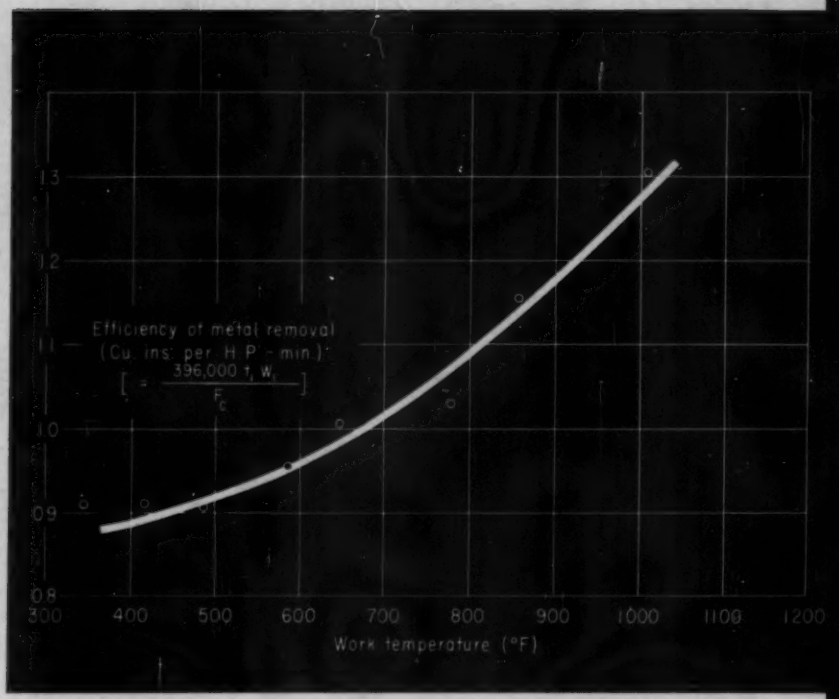
Each end of the 5-ft bar is turned down to 0.995/0.998 in. by 4⅝ in. long, then threaded 1-in.—14 pitch by 1 in. long. The simple cylindrical templet can be seen just under the turret-guiding overarm. Lots are 400 pieces.

Although this is a simpler shape than the average axle, it illustrates the speed and simplicity of contouring jobs. Production rate on most axles run 70 to 80 per day, in lot sizes ranging from 5 to 2000 pieces, and to tolerances of 0.001 in. The tolerance is an improvement over previous conventional operations, where only 0.005 in. could be held, and an extra grinding pass was necessary.

Higher speeds and heavier feeds are possible with the contour lathe, and part-handling time is reduced because all operations are completed at one machine.

Contouring is done in two passes, roughing and finishing, and the same setup does centerdrilling and threading from the turret.

Conventional machining methods just cannot cope with today's new superalloys. As time goes on, these alloys will come into more and more widespread use, and entirely new machining concepts must be created. The Air Materiel Command is already undertaking extensive research in this direction. First, in ultra-high speed machining (AM/MM Special Report No. 484, Feb 22 '60), and in sub-zero machining (AM/MM Special Report No. 489, May '60). And now, here are the results of the initial phase of Air Materiel Command-sponsored research conducted by Cincinnati Milling Machine Co on . . .



Efficiency of metal removal at various work temperatures—turning operation on 360 Bhn AISI 4340 steel

HOT MACHINING

By William Pentland,
research supervisor, project engineer
Clarence L Mehl,
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M A Guenther, senior project engineer
Robert T Krueck, project engineer

The very concept of hot machining runs contrary to established metalworking practice. In the machining of ordinary metals, every effort is made to keep temperatures at the tool-work interface as low as possible to prevent tool damage.

Fundamentally, the idea behind hot machining is to reduce shear strength of the work material so that the metal acquires a plastic character, which eliminates chip formation in the accepted sense.

Chatter is thus reduced, machining power requirements are lessened, and cutting in general is eased.

Even in the working of new superalloys, the theory of sub-zero machining is directly opposed to heating the work—the idea being to maintain temperatures in machining, not to raise them.

We have, then, two completely opposed methods of achieving the same ends—longer tool life and easier cutting. The first, and more conventional method, is to keep the tool cool so as to prolong its life. Hot machining, on the other hand, is an attempt to soften the work by heating it, thus making it easier to cut, and consequently lengthening the life of the tool.

Some steel mills have practiced hot machining for years, cutting still-hot billets with circular saws at cutting rates comparable to sawing logs of wood. Krupp of Germany is said to have scalped billets at about 1800 F during World War

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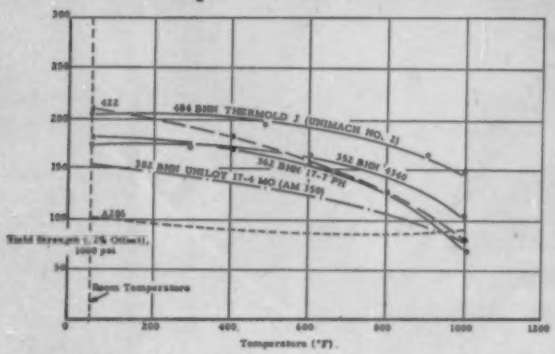
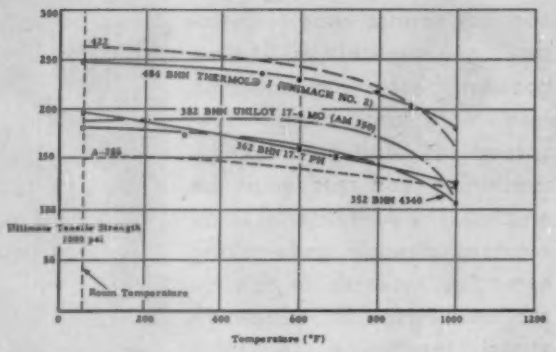
Hot machining . . .

Effect of temperature on various steels


484 BHN THERMOLD J (UNIMACH NO. 2)
352 BHN UNILOY 17-4 MO (AM 350)
352 BHN 17-7 PH
352 BHN 4340
A-286
Yield Strength (.2% Offset), 1000 psi
Room Temperature
Temperature (°F)

On ultimate tensile strength



On yield strength

II, to take advantage of the softened condition of the heated metal.

Steel mills aside, it is difficult to pinpoint who initially conceived the idea that machining at elevated temperatures has its advantages.

One of the earliest indications of the possibilities of hot machining was given by H W Gillett of Battelle, who in 1944 reported preliminary studies in which it was shown that elevated temperatures improve the machining characteristics of "impossible" metals. As a result of this work, Warner & Swasey sponsored further research from spring 1945 through November 1946.

It was during these years immediately following World War II that the idea of using heat as an aid to machinability really began to catch on. In early 1946, for instance, Sam Tour & Co submitted a proposal to the Navy for "Hot-spot machining" research.

Simultaneously, A O Schmidt and J R Roubik started independent tests at Kearney & Trecker. Results of their research, published in 1949, indicated that high-strength die blocks could be milled at higher cutting speeds and feed rates, with equivalent tool life.

Other organizations conducting hot machining research in the decade following World War II included Cincinnati Milling Machine Co. and R K LeBlond Machine Tool Co., in conjunction with International Harvester Co and Tocco Co.

Aside from their efforts, however, the concept received only passing attention until 1956, when Cincinnati Milling surveyed 28 aircraft engineering firms and found them urgently in need of help in machining the new superalloys, which defied conventional methods.

Each of the aircraft firms was asked which types of hard-to-work materials could be expected to be used in the near future. Four representative materials were selected:

- Republic Steel's low-alloy martensite steel, AISI 4340.
- Universal Cyclops' hot-work die steel, known either as Thermold J or Unimach No. 2.
- Armco Steel's precipitation-hardening stainless steel, 17-7 PH.
- Universal Cyclops' precipitation-hardening stainless steel, Uniloy 17-4 MO, also known as AM 350.

MATERIALS USED IN PHASE I

MATERIAL	COMPOSITION								
	C	Mn	Si	Cr	Ni	Mo	Al	Fe	Other
4340	.43	-	-	.8	1.8	.25	-	96.7	-
Thermold J	.50	.40	1.1	5.0	1.5	1.40	-	89.1	1.00V
17-4 Mo	.10	-	-	17.0	4.0	3.00	-	75.8	.15N
17-7 Ph	.07	.65	.5	17.0	7.0	-	1.0	73.8	-

For subsequent tests, which began at The Mill the following year, each of these materials was subjected to two different heat treatments, and specimens were obtained over a 350 to 600 Bhn range.

On each of these four materials the effects of workpiece temperatures were related to such basic quantities of metal cutting as shear angle, shear strength at the shear plane, cutting forces, tool-chip interface temperatures, mean coefficient of friction, and machining efficiency. Flame and radio-frequency induction heating methods were then developed for turning and milling superalloys.

AMC sponsorship since 1959

The Air Material Command, USAF, awarded Cincinnati Milling a contract in 1959. Continuity of the original Cincinnati research has been preserved, however, under the AMC contract.

Meanwhile, since 1957 several companies aside from Cincinnati Milling have been experimenting with hot machining, with results varying from excellent to complete failure. Here are some examples:

April 1958: Hot drilling at North American Aviation showed up to 85% decrease in tool forces (thrust) and up to 10-times increase in tool life in drilling AM 355 CRES, Vasco-Jet 1000, 4340 steel, 17-4 PH CRES, and Inconel X. Temperatures to 750 F were provided by radiant heat.

Also from North American: AM 355 CRES, PH 15-7 MO CRES, Rene 41, and H-11 alloy were heated to temperatures up to 1400 F during machining with resistance heaters. An optimum temperature of 800 F was established for AM 355 CRES.

Boeing Airplane Co at about the same time investigated milling and drilling of AM 355 up to 350 F. In drilling, the work was submerged in hot oil. Result: a sixfold increase in HSS tool life at 350 F. Milling tests showed lower tool life at 200 F and 350 F on a furnace-heated workpiece than was obtained at room temperature.

Chance Vought, drilling tungsten at 600 F increased drill life sevenfold. Hand drilling of HS-25 was much easier at 1000 F.

In January of this year, Spring Garden Innstitute machined excess weld material from railroad rails while they were still hot from weld-

ing (optimum temperature 600 F). Results: a 50% power reduction and a threefold increase in tool life. Also successful: drilling of Hastelloy at 350 to 400 F.

Many of these conclusions have subsequently been supported by AMC-Cincinnati Milling research, which has itself produced such notable conclusions in support of the validity and practicality of hot machining as:

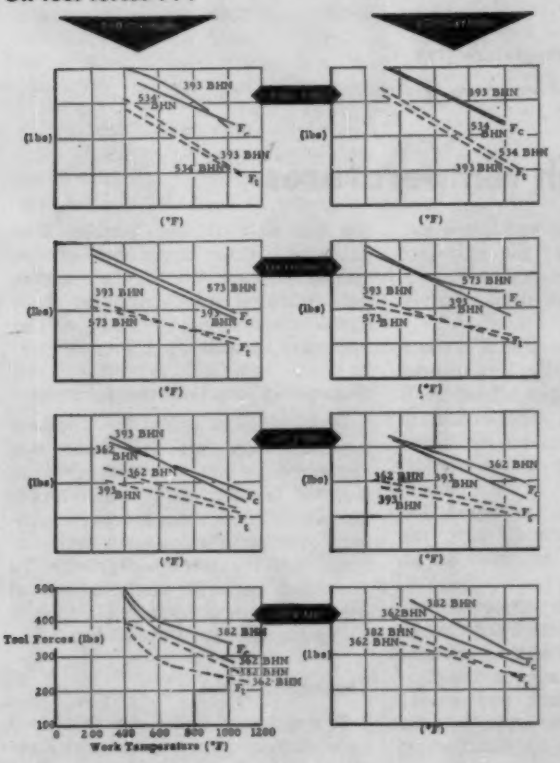
- In orthogonal turning tests—with workpiece temperatures ranging from 73 F to 1200 F—it was found that machining at elevated temperatures improves the efficiency of metal removal, reduces tool forces, and the amount of work done in cutting. At the same time, it was found that tool temperatures do not necessarily increase by the same amount as the temperature of the work is raised. Effect on chip friction and shear plane angle varies with the tool-work material combination.
- Turning at elevated temperatures (to 900 F) improved tool life five times in cutting AM 350 (400 Bhn) and 20 times in cutting AISI 4340 (600 Bhn).
- In face milling operations, results were even more spectacular. At 1000 F, tool life improved 20 times over that at room temperature in face milling 17-4 MO (380 Bhn), and 100 times in milling Thermold J (390 Bhn). It was found that a limiting temperature is reached when welding occurs between chip and tool—at about 1100 F. Other factors influencing tool life: cutter engagement angle with the work, and the presence of asbestos at the entry to the cut.
- Preliminary hot drilling tests on AISI 4340, with HSS and carbide drills, have shown no improvement in cutting performance over conventional room-temperature drilling.
- Upon examination, hot machined specimens showed no detectable change in microstructure, but microhardness checks showed that tempering occurred when tempering temperatures were exceeded—with tempering depth varying with the material and duration of heating. Surface finish was as good or better at elevated temperatures than at room temperature—although some surface oxidation did show up at the higher temperatures. Trouble with work distortion can be overcome by better localization of heat, it was found.
- Two conclusions about heating methods reached in the AMC-Cincinnati tests: (1) High-frequency induction is satisfactory for controlling and maintaining heat, but it is limited to the extent of concentration that can be obtained, and (2) radio-frequency resistance heating can localize and control heat without many of the disadvantages of induction, flame or arc heating.

Those are the principal conclusions to come out of Phase I of the still-continuing AMC-Cincinnati project. Further investigations, based on a survey of industry needs, will be made into hot machining of nickel-base and cobalt-base alloys, and into hot end-milling operations in addition to the turning, drilling, and face-milling operations studied in Phase I.

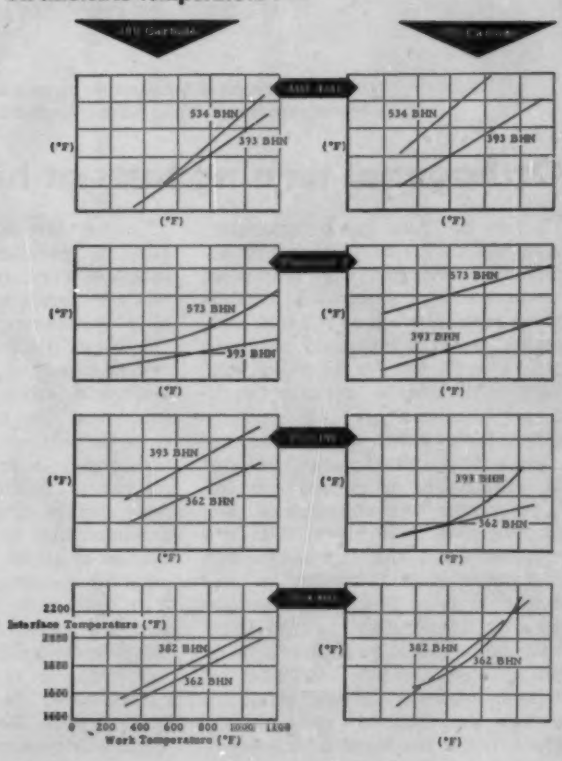
Since tolerances must be strictly maintained in finishing operations, while they are secondary in importance to metal removal rates in roughing operations, indications are hot machining can find immediate application in roughing operations.

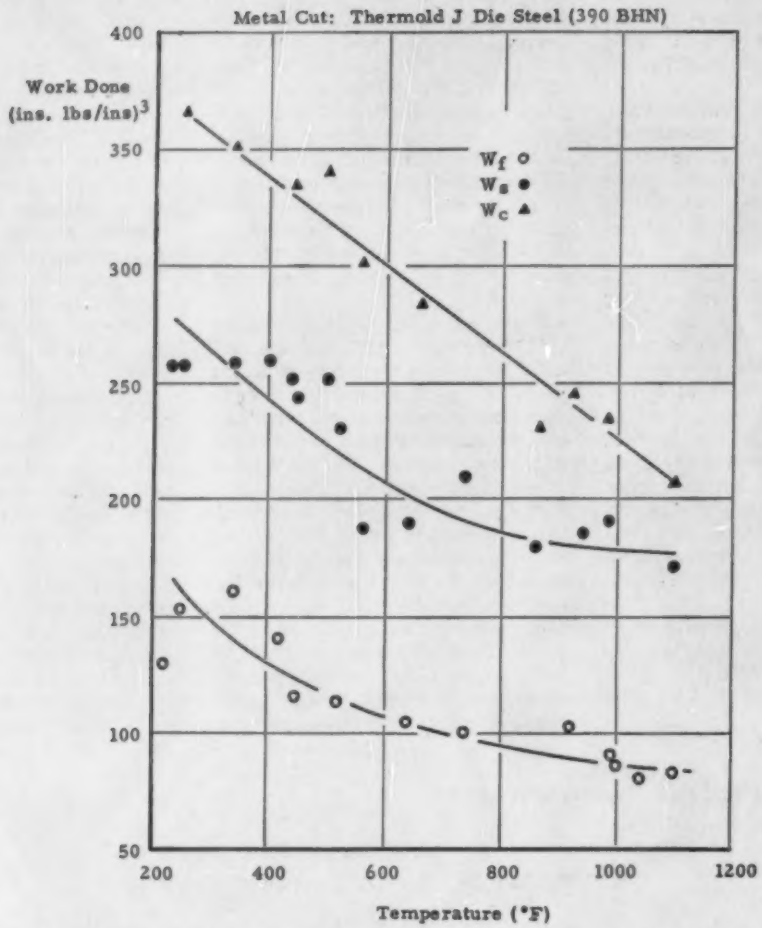
Effects of workpiece temperature

On tool forces . . .



On interface temperature . . .





Effect of workpiece temperature on amount of work done in shearing of metal (W_s), overcoming friction (W_f), cutting the metal (W_c)

Orthogonal turning tests at high temperatures

To find out how basic parameters involved in metal cutting are affected by introducing workpiece temperature as a variable, Cincinnati's researchers used a 2 MH horizontal milling machine, equipped with a chuck to hold the 2⅛-in.-dia, 0.250-in.-thick-wall, tubular workpiece.

The toolpost was held on the machine's table, in an arrangement that is essentially orthogonal turning, because only a two-dimensional tool force system is involved. With this arrangement, and by physically measuring such quantities as tool forces, ratio of feed per revolution to chip thickness, and tool geometry such fundamental quantities as shear plane angle, mean coefficient of friction between tool and chip, and energy distributions could be derived, using the Merchant theory.

Temperature of the workpiece and mean temperature at the chip-tool interface were also measured to obtain the correlation of these to other basic parameters.

The tool itself was held in a force dynamometer, which has a cantilever beam with strain gages affixed to it supporting the tool. Application of force at the tool strains the beam and gages, altering the electrical resistance balance of a wheatstone bridge circuit, to which the dynamometer is wired, and the change of signal is recorded on an amplifier-recorder.

By calibrating this apparatus before the tests, direct readings of the two components of the resultant tool force can be made. In the Cincinnati tests, the work was heated by gas jets. Temperature of the work was measured by shutting off the gas flow to the burner, then using a contact pyrometer on the end of the tube. Tool, dynamometer, and machine were insulated from flame splash, heat conduction and radiation by asbestos sheets.

Measuring interface temperature

Mean temperature at the interface between tool, chip and work was measured by using the interface as the hot junction of a thermocouple circuit (The thermo-electric members: the sintered carbide tool material and the workpiece steel). To overcome parasitic emf's arising at secondary junctions in the circuit, a compensating circuit was used.

The results

It was found that a rise of 1000 F in workpiece temperature gave a re-

duction of 40% to 50% in cutting force (F_c) and reductions of 33% to 66% in thrust force (F_t) at the tool. Workpieces with an initial hardness of approximately 400 Bhn and 600 Bhn, when heated by 1000 F would cut with only a slight difference in tool forces, because their elevated temperature strengths were much closer than their strengths at room temperature.

Effects of raising the temperature of the work upon mean tool-chip interface temperature varied widely with differing tool-work material combinations. For example, Thermold J raised 1000 F in work temperature, caused a rise of 250-350 F in tool temperature. AISI 4340, raised 1000 F in work temperature, caused a rise of 700 to 1000 F in tool temperature; 17-7 PH raised 1000 F caused a 300 to 700 F tool temperature increase; and 17-4 MO raised 1000 F caused a 600 to 1100 F tool temperature rise.

As to shear plane angle and friction between chip and tool it was found that each tool-workpiece combination had to be considered in its own right. For instance, it was found that the mean coefficient of friction between chip and tool in tests with Thermold J and 17-4 MO remained constant with the work temperature increased up to 1000 F. But AISI 4340 steel and 17-7 PH stainless tests indicated that friction could increase or decrease with increased workpiece temperature.

As an example, in hot turning 17-7 PH (390 Bhn) with Carboloy 370 carbide, results were about what can normally be expected in hot machining: The friction angle increased with increasing workpiece temperature, thus decreasing the shear plane angle correspondingly.

Generally speaking, it appears that the angle of the shear plane in chip formation remains fairly constant for AISI 4340 steel and Thermold J as temperature of the work increases, but decreases from 4 to 30 degrees for the two stainless steels evaluated.

Reducing shear strength

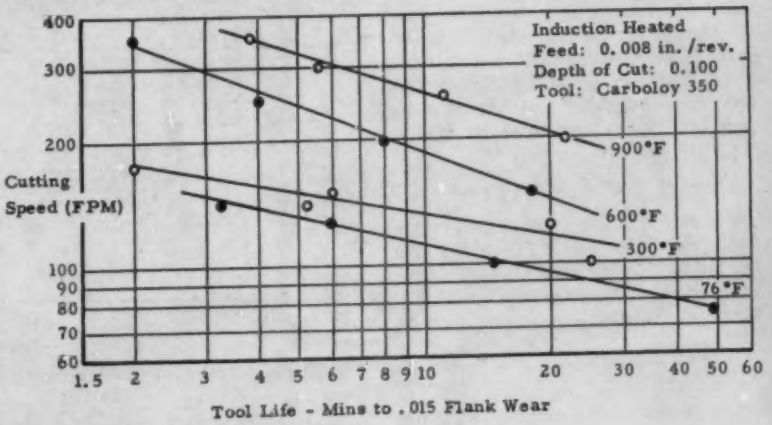
Fundamentally, the idea behind hot machining is to reduce shear strength of the work material, thus easing cutting. In the AMC-Cincinnati Milling tests it was found that calculated mean shear stress on the plane of shear was reduced from 40% to 60% when temperature of the work was raised 1000 F.

Looking into chip formation of high hardness materials in hot machining, researchers found that plastic deformation in cutting is assisted by raising the temperature of the work. At 1300 F and 1500 F work temperatures, the chip was formed by a steady plastic flow of the work material. However, the lower the work temperature gets, the less plastic the deformation becomes. So at 300 F, an AISI 4340 chip, for example, was almost segmented, and was formed with a series of discontinuities along its length through half the thickness of the chip.

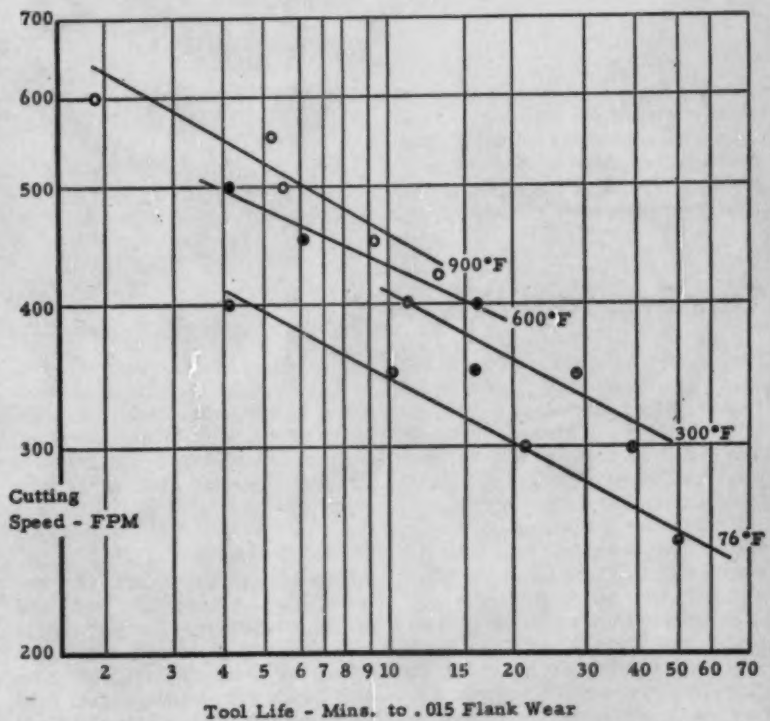
Does hot machining increase the

Effect of temperature on tool life-cutting speed relationship

Turning 4340 steel (600 Bhn, 59 R_c) . . .



Turning AM 350 steel (400 Bhn) . . .



Induction heated. Feed: 0.008 in./rev. Depth of cut: 0.100 in. Tool: Carboloy 350

efficiency of metal removal? Yes—tests showed that efficiency was increased somewhere between 40 and 50% for 1000 F increase in workpiece temperature in cutting, for example, AISA 4340 steel (390 Bhn).

By developing the theory of the mechanics of cutting further, it is possible to calculate the amounts of work done in shearing the metal and in overcoming friction in cutting. The equations used in Phase I of the project:

$$W_s = S_s [\cot \phi + \tan (\phi - a)]$$

where W_s = the amount of work done (in. lb/cu in.) in shearing the metal, S_s = calculated shear stress of material on shear plane, ϕ = shear plane angle, and a = rake angle of tool

$$W_f = \frac{\sin \phi \ (F_t \cos a + F_c \sin a)}{A_o \cos (\phi - a)}$$

where W_f = the amount of work done (in. lb/cu in.) in overcoming friction, F_t = thrust force at tool, F_c = cutting force at tool, A_o = area of cut

$$W_c = \frac{F_c}{A_o}$$

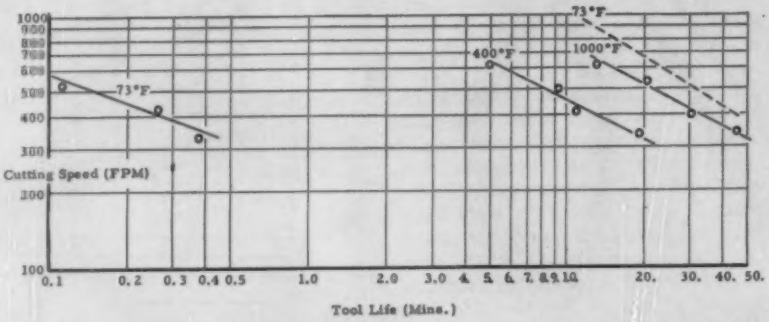
where W_c = total amount of work done in cutting the metal.

Example: quantity of work done was reduced 30% to 50% by elevating a 390 Bhn Thermold J die steel workpiece through 1000 F.

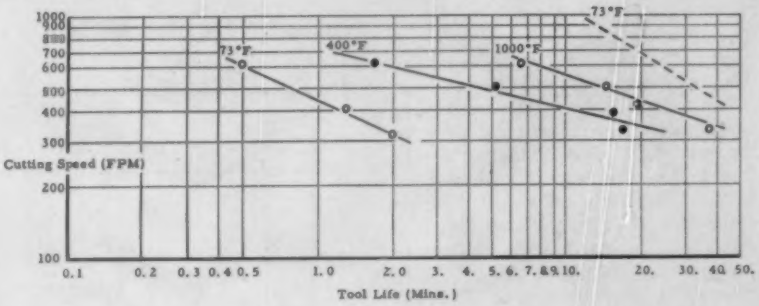
Typical tool life/cutting speed curves at various temperatures

(Constant feed/rev = 0.0065 in. Face milling—single-tooth cutter, 370 carbide)

C1018 steel 150 Bhn (dotted line): 17-4 MO stainless 380 Bhn (black line) . . .



C1018 steel 150 Bhn (dotted line): Thermold J die steel 390 Bhn (black line) . . .



Turning: tool-life tests

In the Cincinnati Milling-AMC turning-tool life tests, it was hoped to run cuts on all four of the superalloys, but the big steel strike of 1959 hit just about that time, and only AM 350 stainless and AISI 4340 were obtainable for testing.

From these two metals, however, researchers achieved one dramatic result (on AISI 4340) and the other (on AM 350) not so dramatic.

Turning was done on a 21½-in. Cincinnati Traytop, and the work was induction-heated by a Cincinnati Inductron unit. An induction coil was mounted on the lathe carriage, traveling with it during cutting and heating the work in a zone just ahead of the tool. Workpiece surface temperatures were measured by a radiometer attached to a recorder. The radiometer was so located as to indicate the temperature of the work as it entered the cut.

Test tools were ½ x ½ x ⅛-in. throwaway carbides. Tool life criterion was 0.015-in. flank wear as measured on a toolmaker's microscope — with measurements taken every two minutes. Where necessary, a linear interpolation was made to pinpoint the exact time of 0.015-in. wear.

Cutting tool geometry

Cutting tool geometry: side and back rakes, 5° negative; side and cutting edge angles, 15°; nose radius, 1/32 in.; and clearance angles, 5°.

Turning tests on AISI 4340 steel (600 Bhn) were made at room temperature, 300 F, 600 F, and 900 F. At 170 fpm cutting speed, tool life increased from less than 2 minutes at 76 F to 2½ minutes at 300 F, about 13 minutes at 600 F, and to about 35 minutes at 900 F. In other words, by raising the temperature of the work from room temperature to 900 F, tool life was increased about 20-fold.

Conversely, where 20-minute tool life is desired, cutting speed at room temperature with this setup should be 95 fpm at 75 F—at 900 F, speed can be raised to 205 fpm.

Not so spectacular were turning results with AM 350 (400 Bhn). At 450 fpm, tool life increased from about 2½ minutes at room temperature, to 7½ minutes at 600 F, and to about 11 minutes at 900 F — roughly a fivefold tool life increase. On the basis of 10-minute tool life, at 76 F a cutting speed of 350 fpm would be necessary, whereas at 900 F, about 460 fpm would be the required speed.

Good surface finish

Surface finish was excellent in all tests, except for some slight oxidation (really only discoloration) at elevated temperatures.

The test cuts produced long, straight chips which did not respond to normal chipbreaking techniques. Various chipbreaker designs were tried unsuccessfully, and no other attempt was made to solve this problem at the time.

Milling four metals over a wide temperature range

How practical is hot milling? To find out, Cincinnati-AMC researchers ran tool life tests over a range of temperatures on the four test metals (AISI 4340, Thermold J die steel, and 17-7 PH and 17-4 MO stainless steels), found that hot milling increased tool life as much as a hundredfold over milling at room temperatures.

The equipment: a Cincinnati No. 4 vertical Dual Power milling machine; a Cincinnati Inductron to provide heat; and for measuring heat a tool-work thermocouple circuit consisting of a mercury slip-ring commutator, compensating resistances, and an oscilloscope.

Induction heating

In the induction heating setup, the work was set with a ⅛-inch air gap between it and the coil, and fed along underneath the coil. As the work came out from under the coil, a single-tooth carbide face-milling cutter milled off the top layer of material.

A typical 8-inch-long pancake coil was used in the tests. Temperature-resistant wrapping tape and asbestos sheeting prevented hot chips from short-circuiting the coil windings. The coil was made of ¼-in.-square copper tubing, through which cooling water circulated at rates up to 12 gal/min.

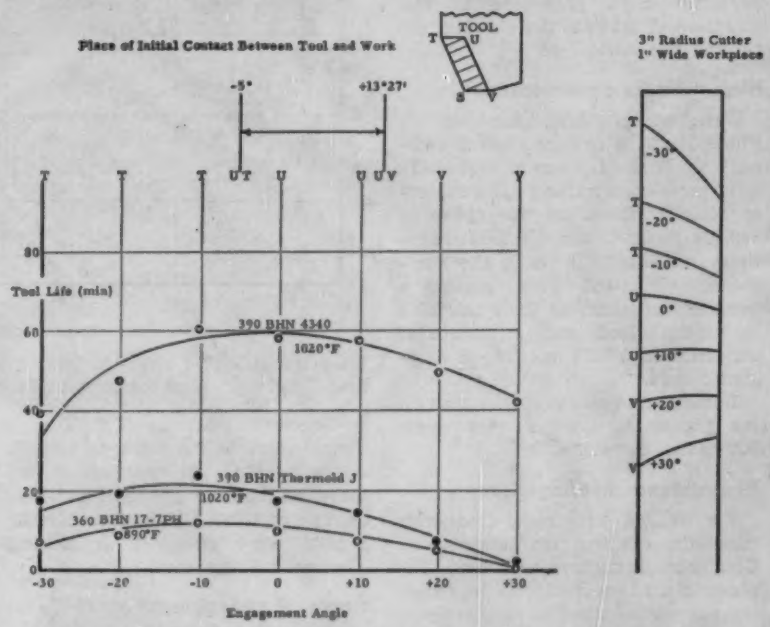
Controlling induced heat

The amount of induced heat was controlled by varying the gap between the coil and the work in the range 1/16 to ½ in., and by altering six of the eight power input settings at the induction heating unit. In this way, temperatures up to 1350 F (for AISI 4340) were obtained.

Flame-induction combination

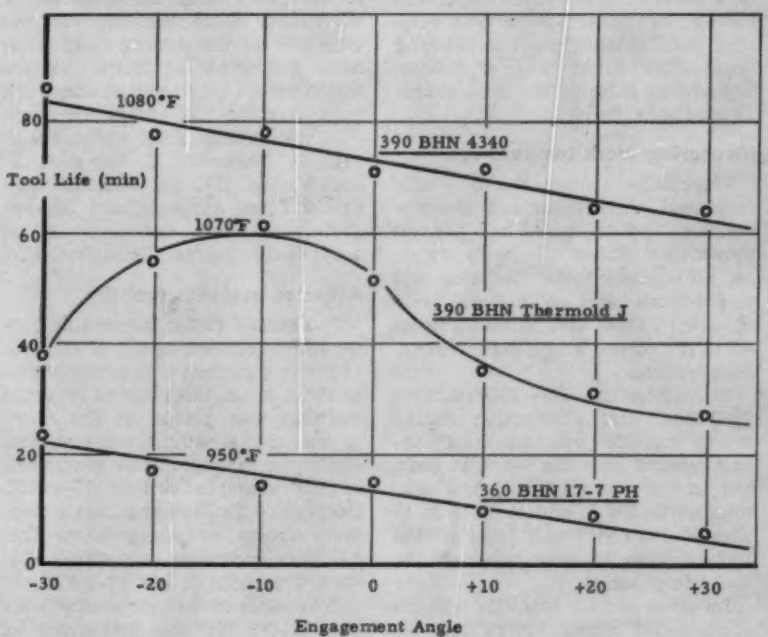
This setup was used for practically all milling evaluations conducted in Phase I. An attempt was made, however, to combine induction and flame heating to heat a low-permeability test piece which did not respond too well to induction heating alone. With this method, the workipece temperature was raised to a level several hundred degrees above that achieved by induction heating alone. Setup involved an induction coil followed by a multi-tip, water-cooled flame head which burned oxygen-propane gas.

Engagement angle in face milling . . .



At left: effects of engagement angle in hot machining (face milling) of 4340 steel, Thermold J, and 17-7 PH stainless. Tool material was 370 carbide, and cutting speed 512 fpm. Feed: 0.0058 ipr. At right: paths of cutting and type of contact for various engagement angles

Effects of engagement angle and asbestos at entry in hot face milling . . .



The tool-work thermocouple used in some of the AMC-Cincinnati Milling tests was arranged in much the same way as that in the orthogonal turning tests. However, two compensating circuits were used to nullify parasitic emf's generated at the junctions of leads to the carbide tool tip and hot workpiece.

High-stiffness dynamometer

Designed primarily for use in Phase II of the project (this is a report on Phase I), was a high-stiffness, three-axes milling dynamometer with stiffness on the order of 500,000 lb/in. in the vertical direction, and 133,000 lb/in. in the horizontal direction. This meant a vertical deflection of 0.002 in./1000-lb vertical load, and a horizontal deflection of 0.0075 in./1000-lb horizontal load.

Natural frequency of the unit in the horizontal direction was about 300 cycles per sec.

RF resistance heating

For milling with radio-frequency resistance heating, the same 30-kw Cincinnati Inductron was used. Instead of an induction coil, however, the current was led to an electrode, then through the work to another electrode, then on to the heating unit via a return conductor that passed close to the surface of the work. Copper tubing, ⅜-in. square, was the conductor—and since RF current prefers the path of least impedance, the heat was localized in a band of that width under the tubing (as opposed to the 5 to 8-in.-long coils in the induction heating tests). The cutter was, of course, brought as close to the heat source as possible.

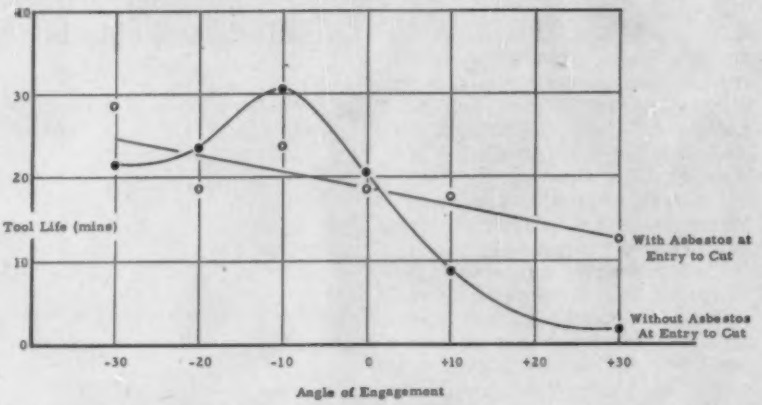
Measuring work temperature

Workpiece temperatures were measured with embedded thermocouples, and by an Alnor contact pyrometer. Unless otherwise stated, on all milling tests, Carboloy 370 single-tooth carbide cutters were used with axial and radial rakes of —7°, 15° corner angle, and 1/16-in. nose radius.

In face milling 17-4 MO stainless (380 Bhn) on the induction heating setup, tool life was less than one-half minute with the work at room temperature, about 5 minutes to 20 minutes at 400 F, and 12 to 50 minutes at 1000 F. Flank wear of the tool of 0.030 in. was taken as the tool life criterion.

In other words, tool life was increased 100 times by raising the temperature of the work to 1000 F. Actually, tool life was about the same as that for conventional machining of a soft C1018 steel. Similar results were obtained in milling Thermold J die steel.

Effects of engagement angle and asbestos at entry in hot milling . . .



Work material: 17-4 MO (360 Bhn). **Tool:** 370 carbide. **Cutting speed:** 512 fpm. **Feed:** 0.0058 ipr. **Work temperature:** 1000 F.

Angle of engagement

In face milling, two factors were found to influence tool life. First was the angle of engagement between the tool and the work as the cutter entered the cut each revolution. This angle is dependent upon the distance between the engagement face of the work and the axis of the cutter, and the diameter of the cutter. These, together with the geometry of the cutting tool, determine the type of initial contact which occurs between tool and work each time the tool enters the work.

In test cuts on AISI 4340 steel at 1020 F, Thermold J die steel at 1020 F, and 17-7 PH stainless steel at 890 F the optimum tool life-engagement angle appeared to be around—10° for maximum tool life.

Asbestos prolongs tool life

The second factor influencing cutter life was the presence of asbestos at the engagement side of the workpiece. A ⅛-in. thickness of crysotile asbestos was placed at the entry to the cut, greatly prolonging tool life under certain cutting conditions, as for example cutting 17-4 MO stainless at positive and highly negative angles of engagement. Tool life also improved in cutting AISI 4340, Thermold J, and 17-7 PH.

It is believed that three effects are responsible for the prolonging of tool life with asbestos: (1) thermal effect caused by the asbestos raising the engagement surface temperature by about 10% over the surface allowed to radiate in air, (2) a possible chemical effect in which the asbestos reacts with the tool or work material, thus acting as a cutting lubricant at the chip-tool interface, and (3) a dynamic effect wherein the asbestos acts as a damper, reducing the severity of impact of the cutter on the work during the intermittent cut.

Tests also indicated that the limiting factor in heating the work is reached when welding occurs between the chip and the tool. In these tests, this temperature was found to be in the region of 1100 F, dependent upon cutting conditions. When this temperature was reached, and welding occurred, tool life fell off rapidly.

High impact forces

Preliminary tests carried out with the milling dynamometer showed that the stiffness of the structure in the horizontal direction was inadequate to cope with the unexpectedly high impact forces occurring during the tests.

Forces higher than 4000 lb were measured, resulting in horizontal deflections of too high a magnitude for the octagonal half-rings to sustain without fracturing. For Phase II of the project, these rings are being made stiffer on another forging by altering the design of the dynamometer. In this way, it is hoped that horizontal stiffness of 1×10^6 lb/in. will be obtained.

Drilling: tool life vs cutting speed

Again, as with hot milling, project researchers set out to find (1) if hot drilling is feasible, (2) effect of drilling temperature on various drill materials, and (3) proper drill life-cutting speed curves for various work temperatures.

Tests were conducted on a 21-inch drillpress with high-speed steel and cobalt high-speed steel drills. Work was heated through by a 3000-watt electric furnace.

Because the drillpress's feed range was limited, tests with carbide-tipped die drills and solid carbide drills were conducted on a No. 5 vertical milling machine. A drilling dynamometer measured torque and thrust force.

Testing with carbides

Increase in thrust force was the criterion in determining tool life, that is, the drill was considered to have failed when a piece was chipped out, or when excessive wear occurred, as indicated by an increase in thrust force. Chipping and excessive wear had to be avoided particularly with carbide drills because of the high grinding costs.

HSS drills of ¼-inch diameter were tested on a block of AISI 4340 steel (534 Bhn or 54 R_c) at room temperature: Tool life at 25 fpm was minuscule. When a feed of 0.005 inches per revolution was used (smallest feed available on the machine), drill failure was by fracture. Hand feed usually gave wear failures.

A very slight improvement in drill life was obtained when the block was heated to 300 F, but tool life dropped off sharply above this temperature. Hot drilling, it is believed, would be more successful with less heat-sensitive tool materials.

Cobalt high-speed steel drills, also ¼ in. in diameter, gave an increase in drill life at room temperatures and at 300 F over HSS drills, but the improvement was too little to warrant further study at the time.

On the other hand, 9/16-in.-dia carbide tipped drills gave greatly improved tool life for holes shorter in depth than the length of the carbide tip. When deeper holes were drilled, the drill shank was fractured at the base of the carbide insert, because of restrictions inherent in chip flow in this type of drill. When these drills might be satisfactory for shallow holes, it was felt that the real test of success for hot drilling is on deeper holes, and future studies should be concentrated on this.

Tool geometry

When solid carbide drills of ½ in. diameter were used with conventional geometry at elevated temperatures, binding and pickup on the margins occurred. To combat these shortcomings, project researchers carried out two modifications:

- The margin was ground with a 5° clearance (in place of the circle grind) for ¼ inch from the cutting lip, and
- A back taper of 0.002 in./in. was ground from the end of the clearance face up the rest of the drill.

These modifications prevented the surface of the block from shrinking on to the drill when it cooled, and also provided a cutting edge to cut the slightly smaller surface hole when the drill was retracted.

Since most of the failures were caused by chipping of the primary cutting edges, a primary 0° axial rake face was ground on the cutting edge in place of the normally positive axial rake. Combined with the actual negative radial rake, this gives a negative normal rake and less chipping. A spiral point grind was used in the tests.

Heat affects tool life

Tool life-cutting speed curves for ½-in. C-2 solid-carbide drills cutting AISI 4340 steel (509 Bhn, 52 R_c) showed highest tool life at room temperature, lowest tool life at 400 F. Apparently, this was caused by the material slowly losing its strength with increasing temperatures in the range up to 400 F. Thus the bulk of the drill was heated by heat transfer from the block, resulting in higher tool-chip interface temperatures—without much loss in the strength of the work material. The 700 F and 1000 F tests gave better tool life. It is possible that at 1200 F, tool life might be better than at room temperature, but tempering of the work was already severe at 1000 F (a loss of 12 points R_c), and researchers felt that going to higher temperatures would be fruitless with through-heating.

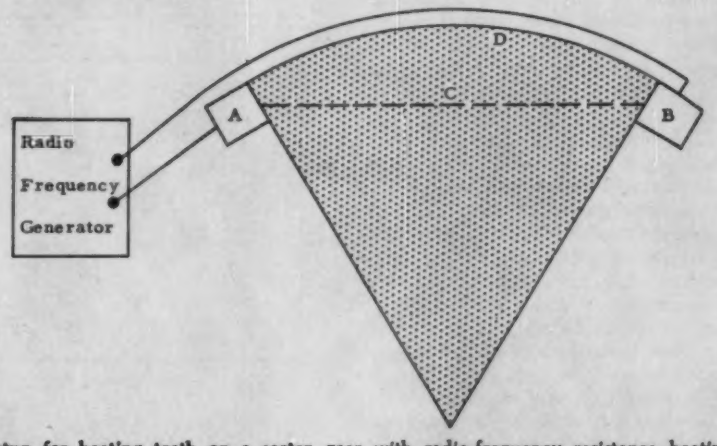
Heating—which source is best?

Ideally in hot machining, the heat would penetrate only to the depth of the cut. In other words, only the shear zone would be heated, because that is where plastic deformation of chip formation occurs.

Preventing heat loss

If any other area is heated, this heat is lost, and the process is less efficient. Whatever method of heating is employed, the area beneath the shear zone (the material beneath the depth of cut) should not be heated. If this occurs, there is a possibility of heat damage to the remaining material.

The ideal heat source, then, must quickly raise the temperature so



Setup for heating teeth on a sector gear with radio-frequency resistance heating

that it can keep ahead of the cutting tool, and this requires a high specific heat input (BTU/sec-in.²). Such a method should be easily controllable, should provide a wide range of constant temperatures, and its results should be reproducible. It should be low in both capital expenditure and operating costs, and it should be easy to set up and safe to use.

That is the ideal. From this point of view, let us look at available methods.

Flame heating

Flame heating has been used in hot machining with varying results since the beginning of the hot machining concept. In its simplest form, flame heating is a welding torch playing ahead of the cutting tool on a machine tool. This technique may be refined by using a multiflame head to increase BTU output and concentrate heat. Fuel is usually oxygen combined with acetylene, propane, or natural gas.

Flame heating is flexible and outlay is relatively inexpensive. For this reason, it is frequently the first choice in heating for experimental purposes.

But it is severely limited by the difficulty of localizing the heat in the work when large heat inputs are needed. In other words, flame heating is for low-temperature work, and it is unsuitable for production applications because of the difficulty of maintaining constant temperature, and its relatively long heating time. Too, flame or hot products of combustion playing over a newly cut surface could damage it.

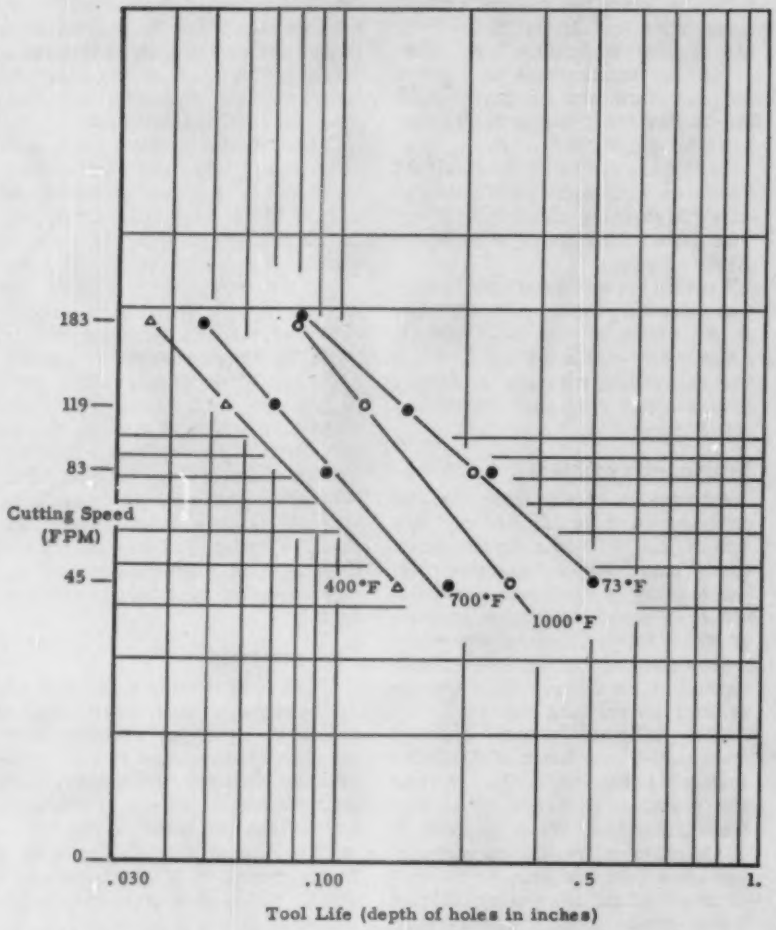
Induction heating

Induction heating is a more sophisticated, and at the same time more expensive method of heating for hot machining. With this method, a current is induced into the workpiece by transformer action. Primary of the transformer is a coil either around or on one side of the work. An alternating current (60 cps to 5 mc is usual) is passed through the coil, inducing current in the work and consequently producing heat which raises the temperature.

The amount of current in the work that can be generated by flux (magnetism generated by the current in the coil) depends on the permeability (conductivity of magnetic lines of force) and resistivity (specific resistance to electrical current) of the workpiece.

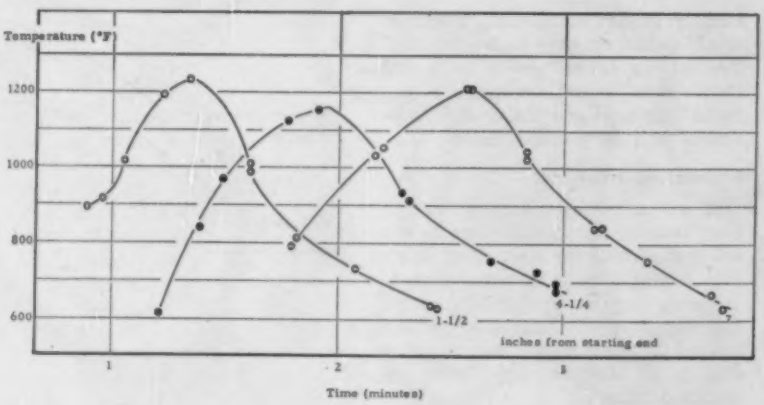
Permeability and resistivity are functions of material composition and temperature. Permeability drops

Effect of temperature on tool life-cutting speed relationship in drilling



Time-temperature relationship for AISI 4340 when induction heating

(Heat input 18 kw. Table feed rate 4½ in/min—1/32 inch beneath the surface)



almost to one when the temperature of the material passes the Curie point (from 1414 F for iron to 2039 F for cobalt), when the work becomes non-magnetic and the current induced in the work is very small. This limits the temperature obtainable with induction heating. And some materials are non-magnetic, are thus very hard to heat by induction.

Penetration of the magnetic heating effect may be found from the formula

$$\delta = 1.98 \sqrt{\frac{\rho}{\mu f}} \text{ inches}$$

where δ = depth of penetration, ρ = resistivity microhm-cm, μ = relative permeability, f = frequency in cps.

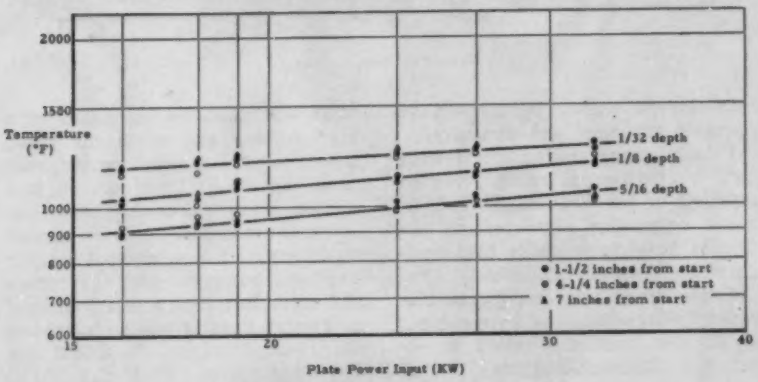
For ordinary steels, this amounts to 0.002 inches at 1000 Kc, or 0.020 inches at 10 Kc.

Because induction heating permits high specific heat input, high temperatures (below Curie temperatures) may be reached in a relatively short time. All of the heat is applied to a thin surface layer, so that localization in depth of temperature is possible.

But the necessary size of the coil makes localization of the heating area difficult, and because induction heating is surface heating, it might be hard to use in such operations as drilling or end milling. Not only that, part configuration could make the coil difficult to design. However, temperature control is simple, results are reproducible, and equipment isn't too expensive.

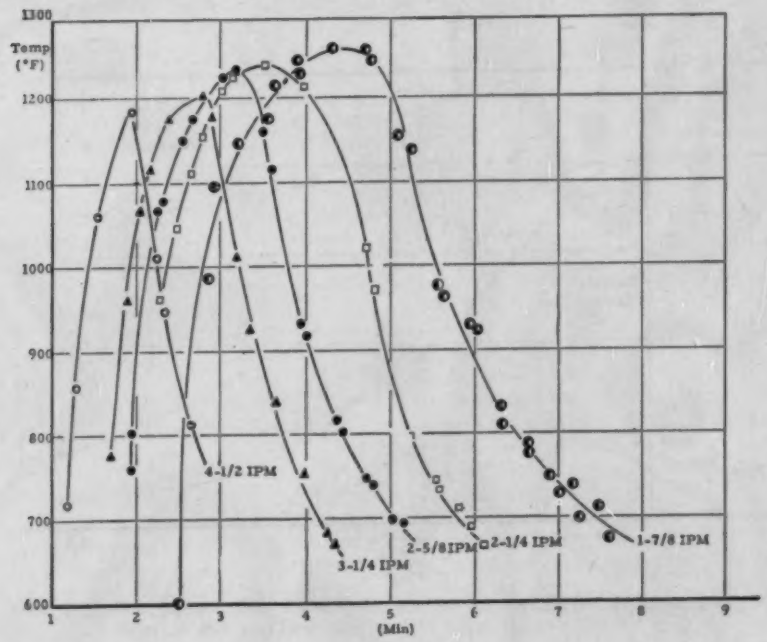
Effect of plate power input on temperature

(At various depths. Table feed rate: 4½ in./min., induction heating)



Effect of table feed rate on temperature

(1/32 inch beneath the surface of the workpiece. Heat input: 19 kw, induction heating)



Furnace heating

Furnace heating, which has been used at various times for hot machining, involves heating the work in an electric or gas furnace, removing the work, and machining it while it cools. This, too, is a relatively inexpensive heating method and, unless the distance between the furnace and the machine is great, a simple one.

For certain operations, this method provides heating for full depth of cut, but usable temperature is limited to that which will cause no thermal damage to the work. Because the work cools unevenly, distortion makes expansion calculations difficult.

Resistance heating

Resistance heating involves passing alternating current either through the work or through heating elements embedded in the work-holding fixture. One advantage of this method is that the workpiece is maintained at a constant temperature, so that distortion and dimensional changes caused by cooling are not a problem. However, when the current is passed through the work, precautions must be taken to protect the operator, and to ensure that no arcing takes place between the electrodes and the work. This could damage the work.

In resistance heating, which incidentally is easy to control, the work is sometimes covered with a molten salt bath or graphite powder to heat the block. Resistance also heats the bath.

RF resistance heating

Radio-frequency resistance heating is based on this principle: radio-frequency current does not follow the path of least resistance, but rather the path of least impedance. All conductors have an inductive resistance which is added vectorially to the resistance to form an impedance. Thus when two conductors (one of them a magnetic material) with current flowing in opposite directions are placed side by side, the

current flows in the magnetic conductor in the area closest to the other conductor.

Arc heating

Arc heating to date has been employed principally in hot turning. The work is grounded or connected to the negative side of an arc welding machine, and a heating arc is drawn just ahead of the cutting tool. To prevent the arc from wandering, a magnetic field can be imposed to direct it. A high-frequency current is often superimposed over the arc current to ionize the air gap—so that the arc will not be extinguished and so that the electrode need not be moved to strike the arc initially. Either an ordinary carbon arc or an inert arc works with this type of heating. Because the latter does not cause electrode wear, no automatic positioning equipment is needed to maintain a constant gap.

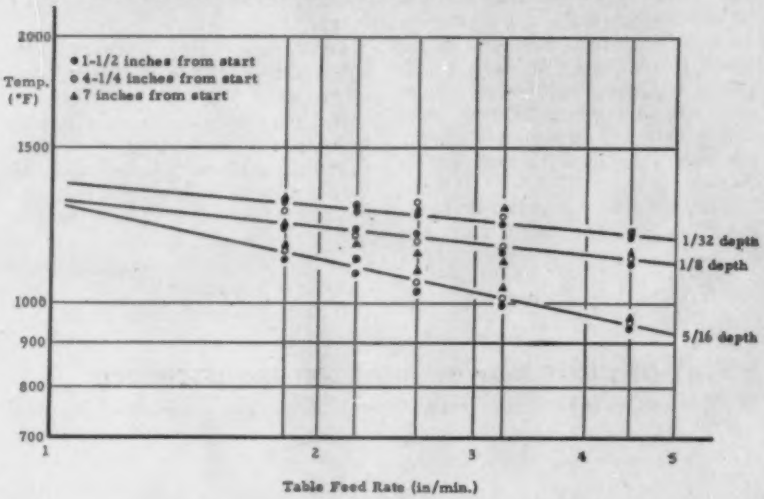
Principal advantage of arc heating is that it supplies a large amount of heat in a small surface area, allowing the heat to be localized both in the surface area and in depth. However, it is difficult to control the heat so as to maintain constant temperatures, and the light from the arc requires that protection be furnished for the operator and for others working in the area. The nature of such protection (welding hoods, gloves, long-sleeved shirts) cuts down on operator efficiency and accuracy.

Finally, there is radiant heating with quartz lamps, which gives off infrared or heat radiation—a technique originally developed to test missile nose cones under high-temperature reentry conditions.

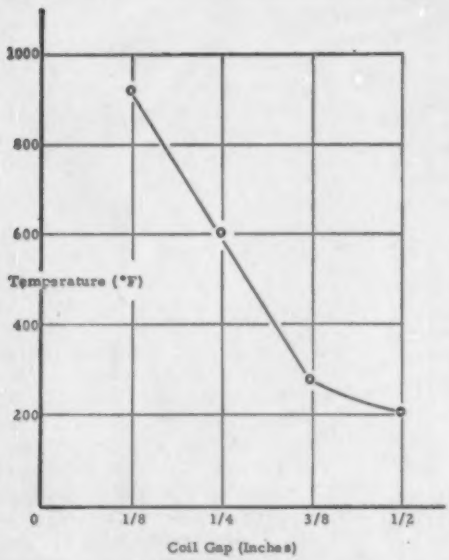
These lamps may be operated at rated voltage, but the power input is so low that the result is essentially through-heating. If the lamps are operated at double the rated voltage and triple the rated power, a high-enough specific heat input can be obtained for surface heating. However, under these conditions the lamps can only be burned continuously for a short time, or they will burn out and the reflectors melt. But if the disadvantages of through heating can be tolerated, this method might be useful for through drilling.

Effect of feed on maximum temperature

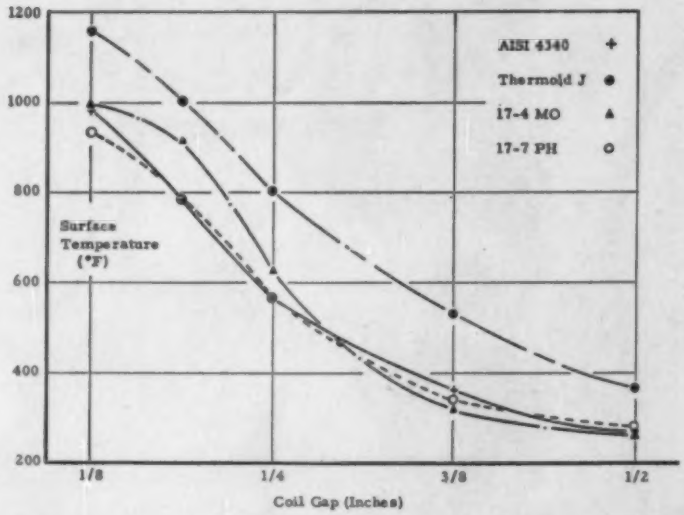
(At various depths. Plate power input: 19 kw, induction heating)



Effect of coil gap on temperature when induction heating



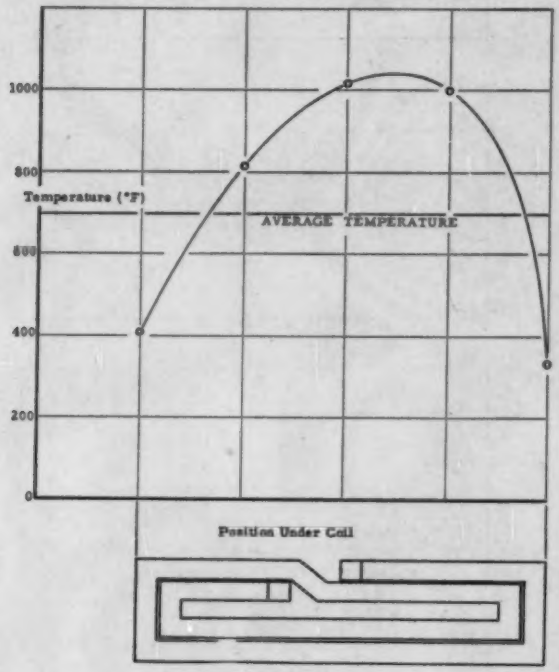
1/32 inch beneath the surface of AISI 4340, power input 19 kw, no feed, heating time 30 seconds



Effect on surface temperature with various materials, plate power input 27 kw, table feed rate 4-½ in./min.

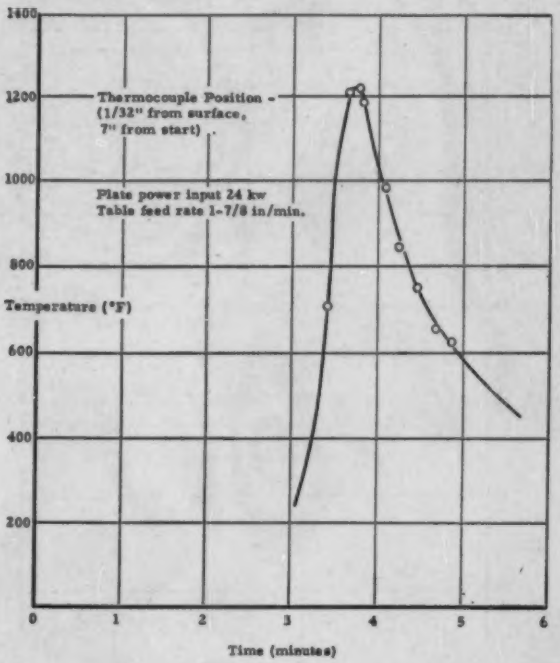
Effect of position under coil on temperature (induction heating)

(Plate power input 19 kw, heating time 30 seconds)



Time-temperature relationship for AISI 4340

(Resistance heating)



Metallurgical effects of hot machining

What metallurgical effect does hot machining have on superalloys? Does it change hardness and microstructure, or distort a finished part?

To find out, researchers on the AMC-Cincinnati Milling project examined each of the four superalloy test materials at two hardness levels (because of differing hardness treatments). Comparison of metallurgical effects was made in face milling 1 x 5 x 12-in. workpieces, using radio-frequency induction versus radio-frequency resistance heating.

Surface temperatures of the work during a single pass taken across the 1-in.-wide surface were:

Thermold J (390 and 570 Bhn)—1010 F.
17-4 MO (360 Bhn)—945 F.
17-4 MO (380 Bhn)—960 F.
17-7 PH (360 Bhn)—945 F.
17-7 PH (390 Bhn)—980 F.
AISI 4340 (390 Bhn)—990 F.
AISI 4340 (540 Bhn)—980 F.

Induction-heated test specimens of Thermold J hot work die steel (390 Bhn—double-tempered at 1100 F) were mounted for metallographic examination in such a way that the microstructure of the piece could be examined from the hot-machined surface to a point approximately ½ inch beneath the surface (sample A). This microstructure was compared directly to that of another sample (B) taken from the bottom (unmachined) portion of the workpiece. Both samples were mounted on the same mount — polished, etched, and photographed together.

This procedure, which in essence is the same followed in testing all the induction-heated test specimens, showed in the case of the Thermold J steel that the microstructure was not changed by temperatures attained during hot machining. The microstructure was in all cases tempered martensite. An examination of the hardness traverse showed that hot machining temperatures did not affect the original hardness of the sample, and grain did not coarsen.

The same procedure was followed in testing induction-heated test specimens of Thermold J (570 Bhn —tempered at 800 F). An examination of the A sample (taken from the hot machined surface to a point about 1.2 inch below), showed that its hardness decreased about 4 Rockwell C points for a depth of ⅛ inch during hot machining. The work had been heated during the process to more than 975 F to this depth, and the 900 F tempering temperature had been exceeded to a depth of at least ¼ inch below the hot machined surface.

(Published data for this steel shows that no decrease in hardness should be expected when the tempering temperature is increased from 800 F to 975 F—above 975 F hardness is decreased.) This accounts for the decrease in hardness in the first ⅛ below the surface, and for the lack of softening in the second ⅛ inch, even though no evidence of hot machining temperatures in excess of the grain-coarsening temperature was observed.

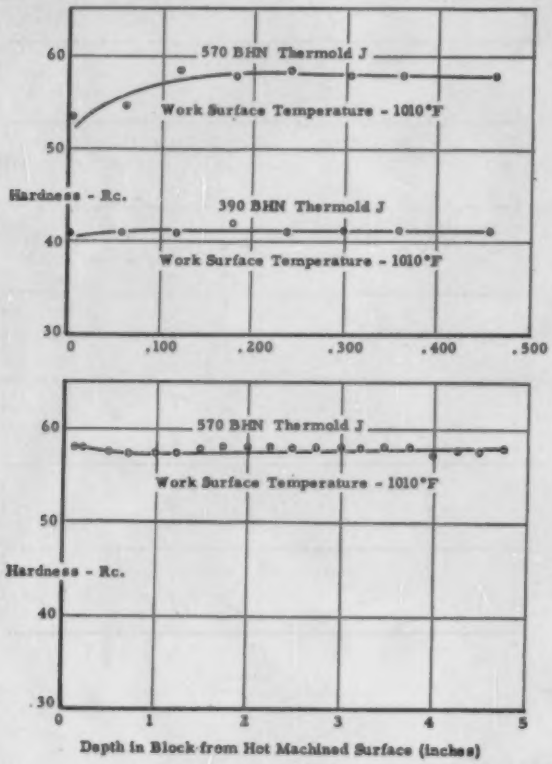
Induction-heated test specimens of 17-4 MO stainless steel (360 Bhn—double-aging treatment) upon examination of microhardness traverses showed that hot machining caused a decrease in hardness

Hot machining . . .

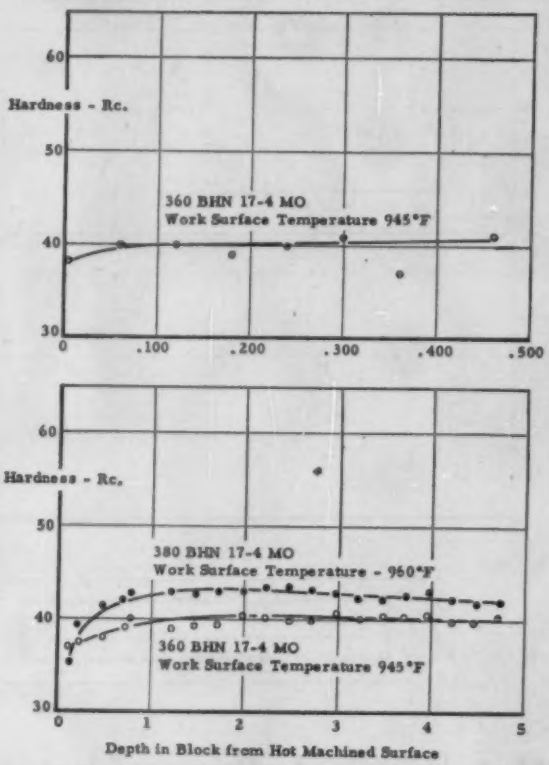
Effects of hot machining on hardness

(Hardness vs depth from hot-machined surface—induction-heated)

. . . on Thermold J



. . . on 17-4 MO



to a depth of about ⅝ of an inch. But the microhardness values are somewhat erratic—the decrease in hardness could possibly be caused by over-aging at the hot machining temperature.

Also, some differences in microstructure may have been caused by a change in composition in the surface layers resulting from reaction with furnace atmospheres during heat treating—because the B sample (from the unmachined bottom of the workpiece) also showed a lack of grain boundary definition after being exposed to furnace gases during heat treatment.

Test results with 17-4 MO stainless (380 Bhn—sub-zero treatment) showed a decrease in hardness to a depth of about 1 inch resulting from hot machining temperatures, but no change in microstructure was detected.

Induction-heated test specimens of 17-7 PH stainless steel (360 Bhn —heat treatment: reheating TH 1050) indicated some reduction in hardness adjacent to the hot-machined end of the sample section. But this, it was felt, might be a result of the heterogeneous microstructure, rather than the hot machining operation. Hardness readings lower than those near the hot-machined surface were obtained in areas remote from this surface. No difference was detected in microstructure adjacent to the hot-machined surface, compared to that in other portions of the sample.

Specimens of 17-7 PH stainless (390 Bhn — heat treatment: TH 1050) showed exactly the same results as those of the 360 Bhn 17-7 PH.

Induction-heated test specimens of AISI 4340 martensitic steel (390 Bhn—drawn at 1000 F) upon examination of microhardness and Rockwell C hardness traverses indicated that a slight decrease in hardness may have resulted from tempering occurring during hot machining. No detectable difference in microstructure existed between the two samples of this metal, both of which were composed of tempered martensite.

Induction-heated test specimens of AISI 4340 martensitic steel (540 Bhn—oil-quenched and air-cooled) upon examination of the hardness traverse showed that sample A had been retempered for approximately 2½ inches from the hot-machined surface. A decrease in hardness and a change in microstructure indicate that temperatures attained during hot machining exceeded the original tempering temperatures of the workpiece.

Microstructure of both samples A and B was essentially tempered martensite. The only difference in microstructure between the two samples was that the martensite in sample A was tempered more than that in sample B. No other microstructural changes were observed.

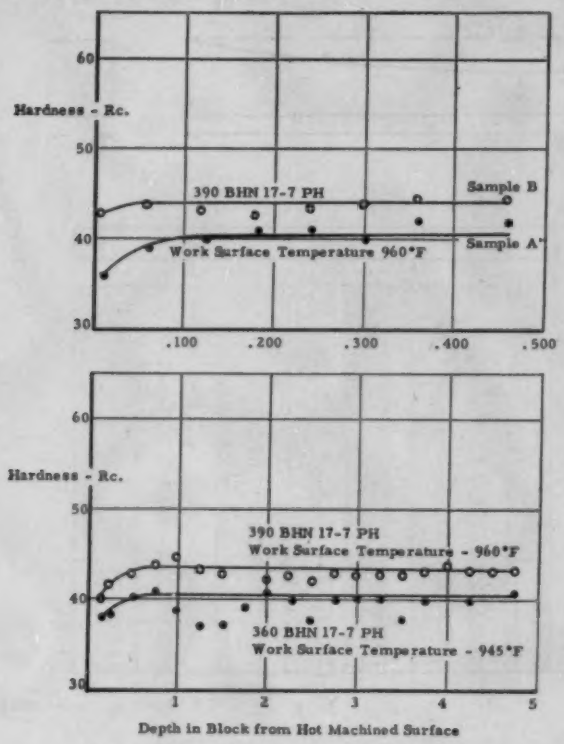
Radio-frequency resistance-heated test specimens of AISI 4340 martensitic steel (300 Bhn—drawn at 1000 F) upon examination of microhardness and Rockwell C hardness traverses indicated that very little, if any, change in hardness resulted from hot machining. No detectable differences in microstructure existed between samples A and B, both of which were of tempered martensite.

With radio-frequency resistance-

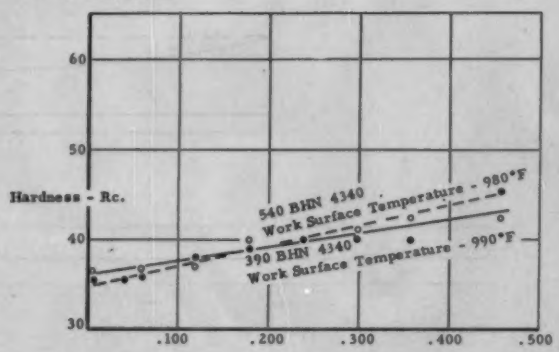
Effects of hot machining on hardness

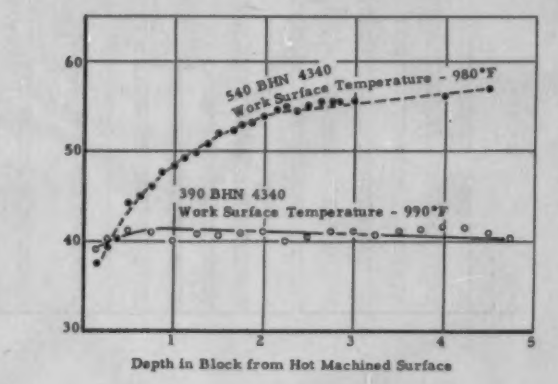
(Hardness vs depth from hot machined surface—induction heated)

. . . on 17-7 PH



. . . on AISI 4340





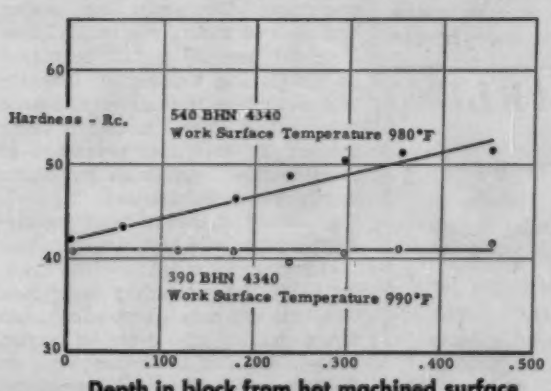
heated test specimens of AISI 4340 martensitic steel (540 Bhn — oil-quenched and air-cooled), examination of the microprint and hardness traverse showed that the piece had been retempered for approximately ¾ inch from the hot-machined surface. The decrease in hardness and change in microstructure showed that temperatures reached during hot machining exceeded the original tempering temperature of the work. No other changes were observed in microstructure.

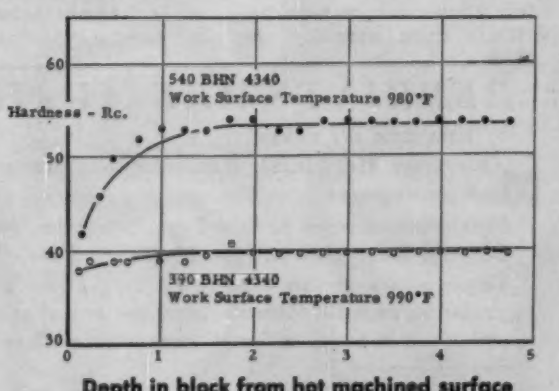
End results

Summed up, it was found that the workpiece (using as an example AISI 4340, 390 Bhn) showed a loss of hardness 0.300 inch beneath the surface, while no loss of hardness was evident 0.004 inch beneath the hot-machined surface with R F-resistance heating. Hardness traverse showed some tempering of AISI 4340, 540 Bhn, work to a depth of 1 inch with R F-resistance heating—not nearly as deep or severe as the 2½ inches of tempering obtained with induction heating.

Effects of hot machining on AISI 4340

(Hardness vs depth from hot machined surface—RF resistance heated)

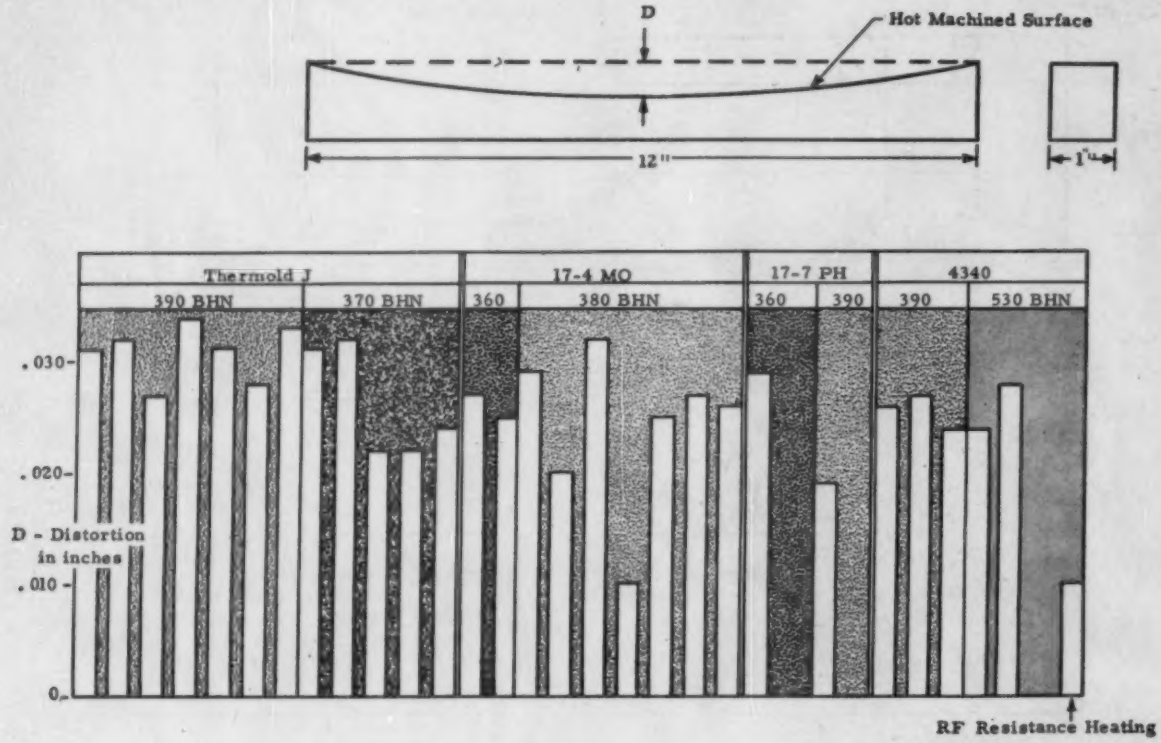




Hot machining . . .

Distortion encountered in hot machining when milling

(Induction heated and also resistance heated)



A few words about safety in hot machining

Hot machining, while not dangerous, does present more hazards than conventional production machining. For example:

- Asbestos gloves are necessary for loading and unloading the heated work, and care must be taken to let the work cool in a protected place so that personnel do not inadvertently touch it.
- Constant glow from the hot work could affect workers' eyes, so tinted safety glasses may be required.
- While chips normally are not much hotter than those in ordinary production, higher production rates increase their number—and protective guards (preferably of transparent plastic for a clearer view of operations) are necessary.
- The operator must be protected from heating apparatus, especially during flame heating, when clothes could catch fire. If electricity is used, only low voltages should be applied if possible for reasons of operator safety. Higher voltage may be tolerated for radio-frequency heating, because this current flows over, rather than through a person.
- Exhaust blowers may be necessary if vaporous or toxic friction agents are used, or if the work is coated with oil. If hot machining is going on at several machines, blowers hold temperature down.
- Machine tools should be protected. Asbestos sheeting can interrupt all paths of conduction to the machine. If any part of the machine is heated excessively, oil temperature should be checked and if necessary a larger sump should be provided.

What next?

Obviously, Phase I of the project has proved the high potential of hot machining. Obviously, too, major emphasis on future research (Phase II of the project) should be placed on developing techniques for concentrating heat in the zone of plastic deformation when the chip is being formed. To this end, repetition of more-routine machinability tests should be de-emphasized.

A survey of the needs of the aircraft and missile industry indicates that further investigation into application of hot machining techniques to nickel and cobalt-base alloys, and to end milling operations be carried out—in addition to further work on drilling and face-milling operations.

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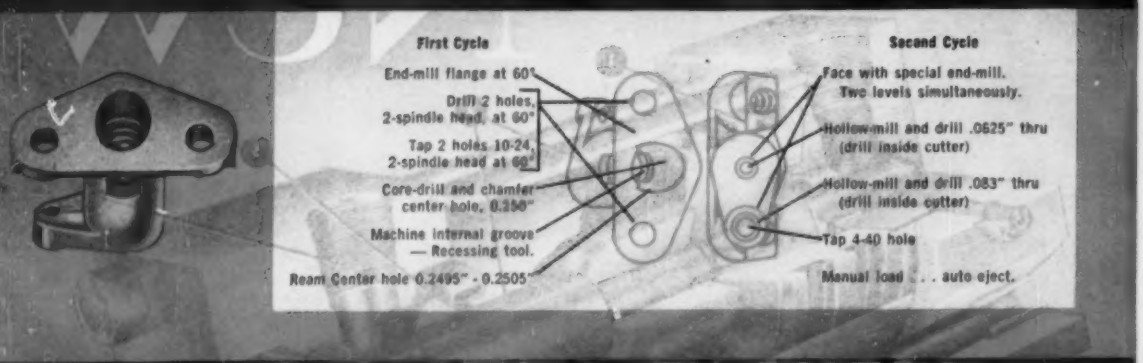
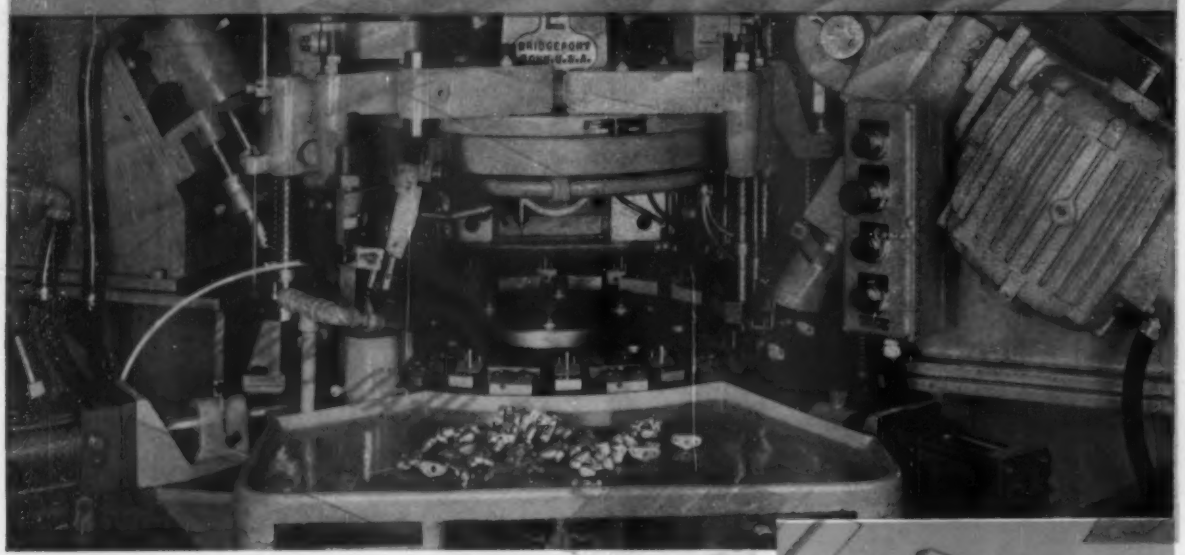

First Cycle
End-mill flange at 60°
Drill 2 holes, 2-spindle head, at 60°
Tap 2 holes 10-24, 2-spindle head at 60°
Core-drill and chamfer center hole, 0.250"
Machine internal groove — Recessing tool.
Ream Center hole 0.2495" - 0.2505"
Second Cycle
Face with special end-mill. Two levels simultaneously.
Hollow-mill and drill .0625" thru (drill inside cutter)
Hollow-mill and drill .083" thru (drill inside cutter)
Tap 4-40 hole
Manual load . . . auto eject.



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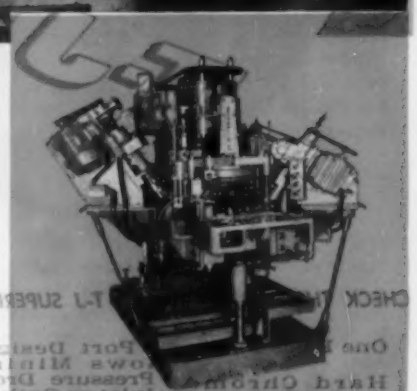

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Center of Gravity for Dies—I

By Ferenc C Kuchta, mechanical engineer, J Wiss & Sons Co, Newark, N J

The die designer or diemaker must match the center of gravity of the die with the die-shank center. Incorrect matching can cause die-set cocking, unnecessary die failure, shorter die life and extra cost of die maintenance. The following methods are simple ways to find the exact location of the center of gravity of dies.

There are two conditions to be considered:

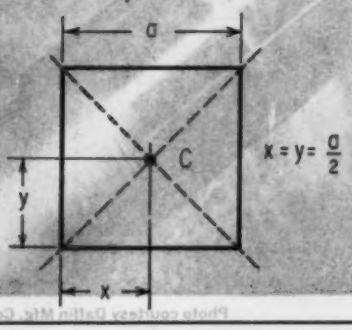
1. The die has a single punch.
2. The die has two or more punches at various locations on the punch plate.

Let us first consider a die with a single punch. The punch may have a cross-section like one of the simple geometrical figures below. Note: the circle is not shown because its center is likewise the center of gravity.

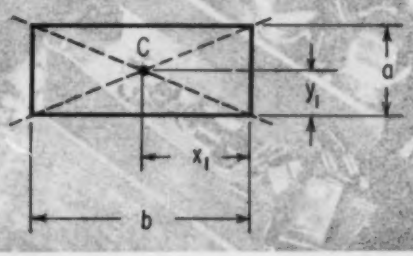
In other cases, the punch may be symmetrical about a centerline, as shown on page 137. The center of gravity will be found on that centerline. Exact location of the center of gravity is found by splitting the punch outline into simple geometrical figures and finding their moments with reference to any convenient axis at right angles to the centerline.

Other cases involve single punches that are not symmetrical to any axis, and examples where moments must be taken in relations to two axes because more than one punch is involved. These cases will be considered in a future installment.

Square



Rectangle



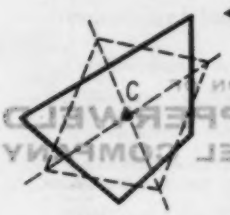
Center of gravity is at intersection of the diagonals

Trapezoid

$$y_1 = \frac{H}{3}\left(\frac{2a+b}{a+b}\right) \qquad y_2 = \frac{H}{3}\left(\frac{2b+a}{a+b}\right)$$

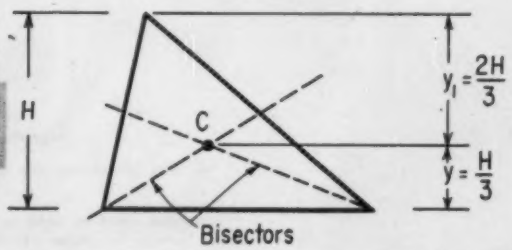
The center of gravity of a trapezoid is on the line joining the midpoints of parallel sides AB and CD

Any 4-Sided Figure



◀ Each of the sides is divided into 3 equal parts. A line is then drawn through each pair of division points next to the points of intersection. These lines form a parallelogram and the intersection of the diagonals of this parallelogram locates the required center of gravity.

Triangle



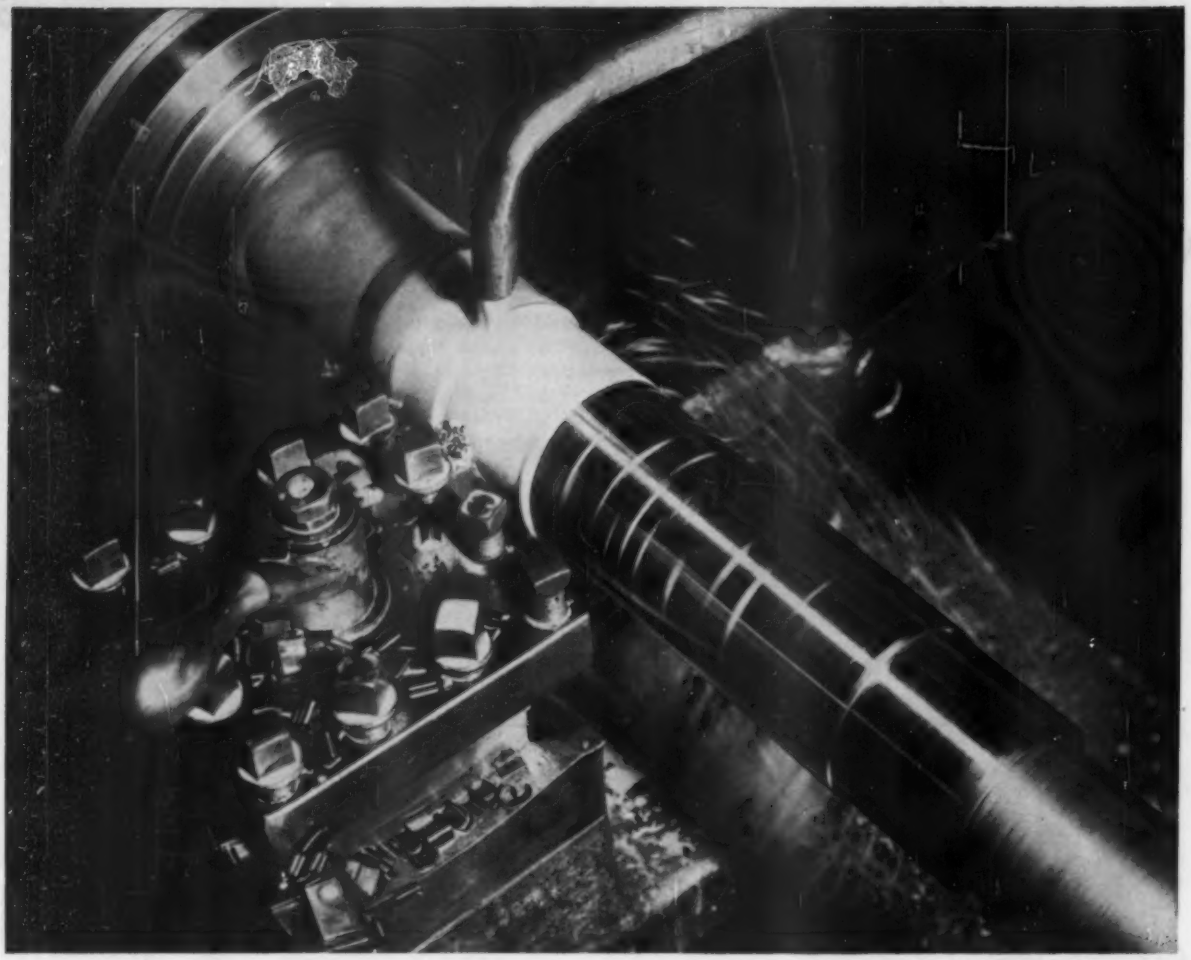


Photo courtesy Daffin Mfg. Co.

Aristoloy Leaded reduces cost 50% on drive shaft for Daffin Mfg.

Daffin engineers were skeptical when the Copperweld representative said Aristoloy Leaded* steel would reduce production costs of a 500 lb. drive shaft . . . but today savings are 50% greater compared with the steel formerly used.

Lower cost of material (an unleaded nickel alloy was formerly used), longer tool life and increased feed and speed are responsible for the savings.

The finished part reveals no detectable difference in physical properties.

And, since switching to Aristoloy, Daffin reports "uniformity of the steel has been much more consistent."

For complete information call the Copperweld representative in your nearest large city . . . or write today for New Products & Facilities Catalog.

* Inland Ledloy License

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DIVISION OF
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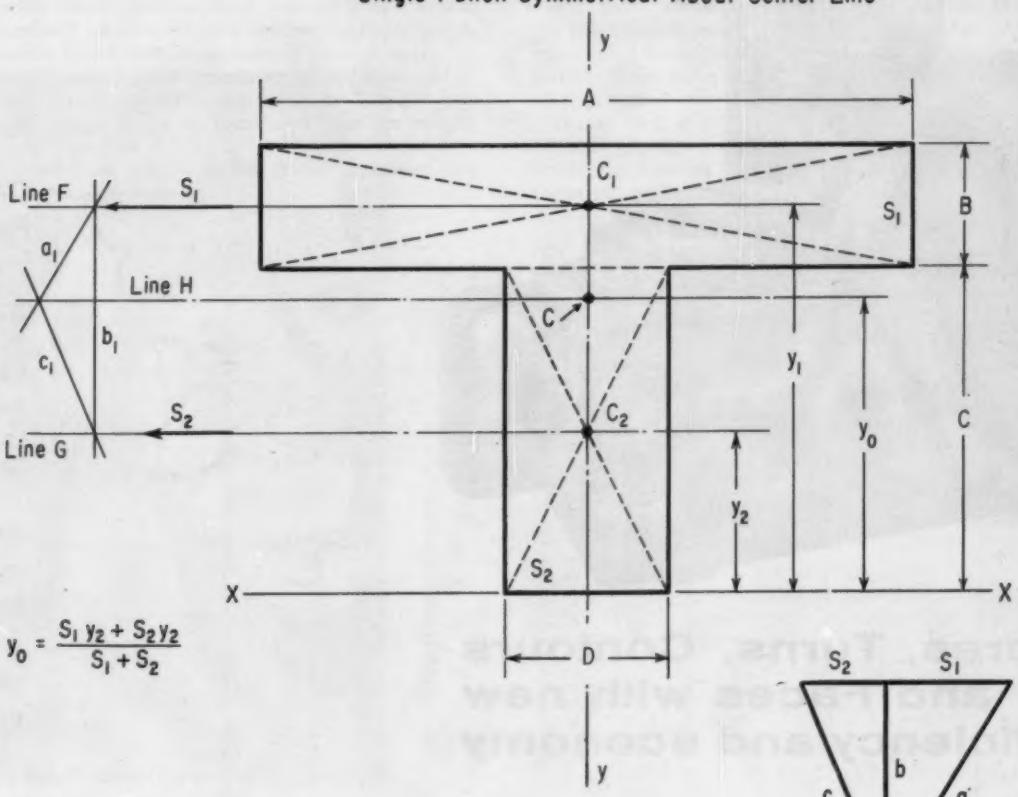
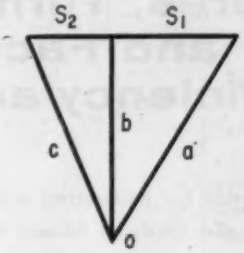
Center of Gravity for Dies—II

Single Punch Symmetrical About Center Line



$$y_0 = \frac{S_1 y_2 + S_2 y_2}{S_1 + S_2}$$



Force Polygon

Mathematical Solution:

1. Divide punch outline into geometrical figures; in this case, two rectangles
2. Find center of gravity of each figure
3. Calculate area of each figure (S_1 and S_2)
4. Multiple areas times respective moments (Y_1 and Y_2)
5. Calculate Y_0 from formula

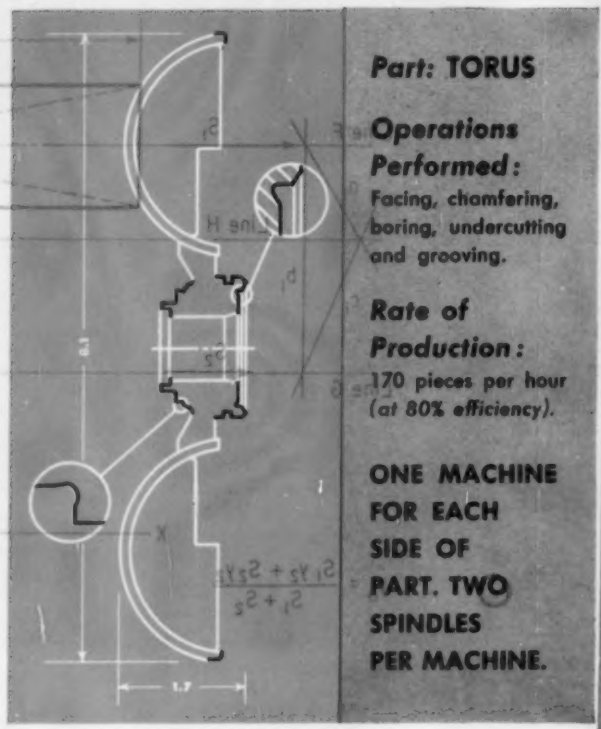
Example $A = 4$, $B = 0.750$; $S_1 = 4 \times 0.750 = 3$
$C = 2$, $D = 1$; $S_2 = 2 \times 1 = 2$
$Y_1 = C - B/2 = 2.375$,
$Y_2 = C/2 = 1$; $Y_0 = \frac{3 \times 2.375 + 2 \times 1}{3 \times 2} = 1.825$

Geometrical Solution:

1. Follow steps 1, 2, 3 above
2. Take any axis $X - X$ at right angles to centerline.
3. Draw Lines F and G through center of gravity of the two rectangles.
4. Construct force polygon. Draw S_1 and S_2 to any scale. From any convenient pole O, draw lines a, b and c.
5. At lines F and G draw lines a_1, b_1, and c_1, parallel to similar lines on force polygon. The intersection of a_1 and c_1 gives line H, which passes through the center of gravity C of the punch.

Announcing the

NEW OLOFSSON MODEL 41, AIR-OPERATED CAM-CONTROLLED MACHINE



***Part:* TORUS**

Operations Performed:
Facing, chamfering, boring, undercutting and grooving.

Rate of Production:
170 pieces per hour *(at 80% efficiency).*

ONE MACHINE FOR EACH SIDE OF PART. TWO SPINDLES PER MACHINE.

Bores, Turns, Contours and Faces with new efficiency and economy

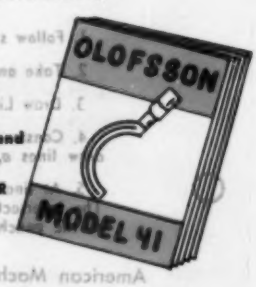
Designed for generating accurate contours mechanically, the Olofsson Model 41 brings new efficiency and economy to boring, turning, contouring and facing operations like those diagrammed above. Its low height to width ratio of spindles to ways provides maximum stability and smoothness to *repetitive* machining operations. And, on multiple operations it is necessary to check just one dimension from each tool used, all other dimensions will be in relation.

The cam-controlled stroke is 4" on both main and cross slides. Cams are mounted on the same shaft, and both table slide and cross slide are in *direct contact* with their respective cam. No linkage is involved. Both cams and cam followers are completely submerged in oil; can be quickly and easily changed.

All machine functions are electrically interlocked. Air power supply is from 70 p. s. i., minimum.

Your Olofsson representative will be glad to suggest profitable applications for your operation. Call him, or contact Olofsson *in Lansing.*

Descriptive literature on the Model 41 is yours for the asking. Write today.



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REFERENCE BOOK SHEET

Weight Calculator for Magnesium, Aluminum, Steel

Reprinted from *Magnesium*, published by Brooks & Perkins, Inc., Detroit

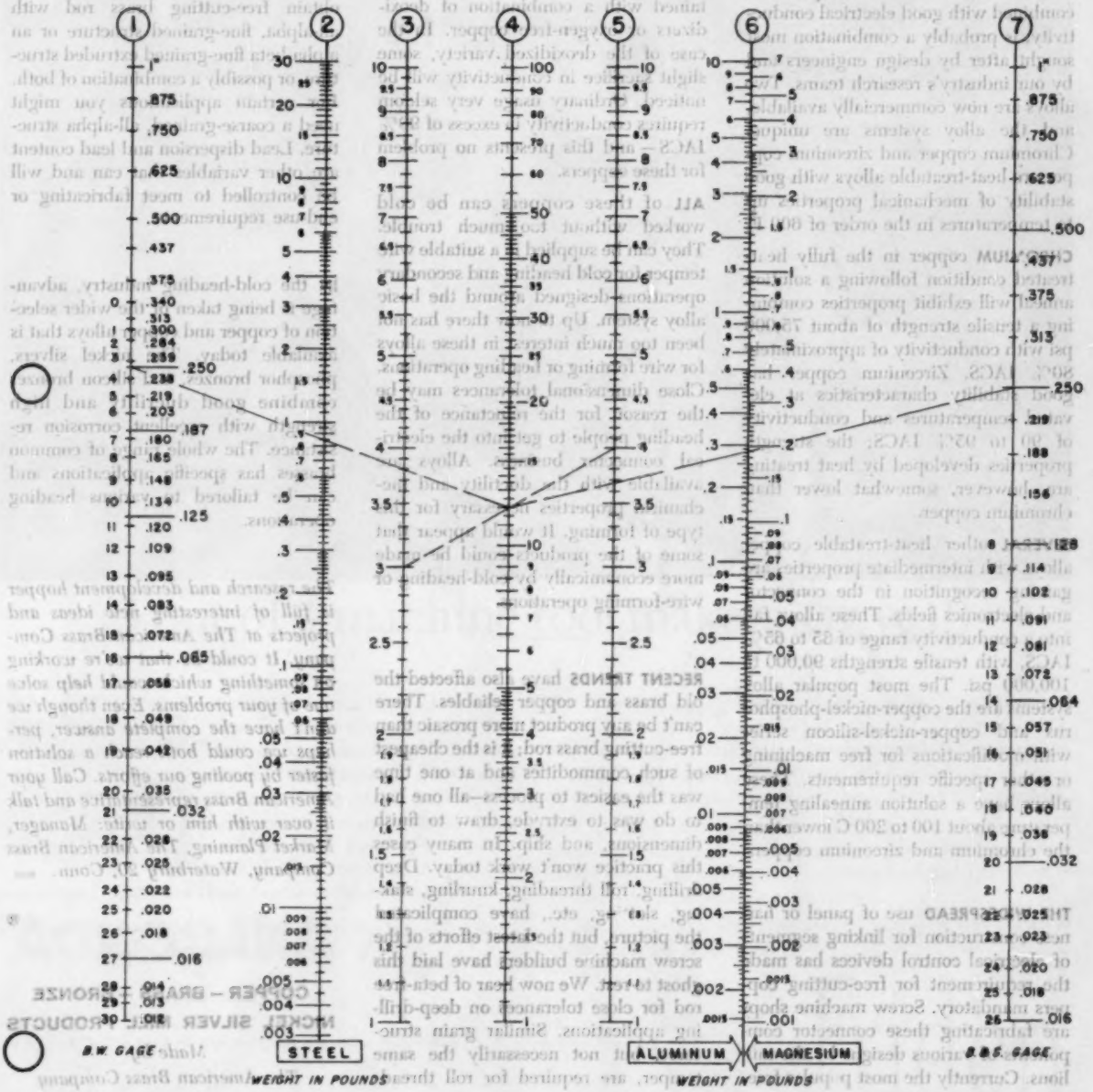
Locate length and width of part on lines 3 and 5, respectively. A straight line connecting these points intersects line 4, indicating area of part in sq in.

For magnesium and aluminum locate thickness of part on line 7. Connect this point by straight line with the value found on line 4 and read the weight in pounds on line 6.

For steel use line 1 for thickness and read the weight value on line 2.

For parts whose width or length exceeds 10 in. (or thickness exceeds 1 in.) use the nomogram without regard to decimal point until the weight is obtained. Then move the decimal point of your result, as required.

If one, two, or all three factors are multiplied by 10, multiply the answer by 10, 100, or 1000, respectively, by moving the decimal point one, two, or three places to the right.



(Advertisement)

NEW IDEAS IN COPPER ALLOY ROD AND WIRE

Interesting things happen when you add a spot of zirconium or chromium to copper—four high-conductivity coppers that boost production, cut cost of machining—even plain old free-cutting brass rod is going fancy.

There's a quiet revolution going on in copper metallurgy. Research and development teams are expanding the useful knowledge of copper and copper alloys in an effort to define the properties most suitable for specific engineering applications.

STABILITY at elevated temperature, combined with good electrical conductivity, is probably a combination most sought after by design engineers and by our industry's research teams. Two alloys are now commercially available, and the alloy systems are unique. Chromium copper and zirconium copper are heat-treatable alloys with good stability of mechanical properties up to temperatures in the order of 600 F.

CHROMIUM copper in the fully heat-treated condition following a solution anneal will exhibit properties combining a tensile strength of about 75,000 psi with conductivity of approximately 80% IACS. Zirconium copper has good stability characteristics at elevated temperatures and conductivity of 90 to 95% IACS; the strength properties developed by heat treating are, however, somewhat lower than chromium copper.

SEVERAL other heat-treatable copper alloys with intermediate properties are gaining recognition in the connector and electronics fields. These alloys fall into a conductivity range of 35 to 65% IACS, with tensile strengths 90,000 to 100,000 psi. The most popular alloy systems are the copper-nickel-phosphorus and copper-nickel-silicon series with modifications for free machining or other specific requirements. These alloys have a solution annealing temperature about 100 to 200 C lower than the chromium and zirconium coppers.

THE WIDESPREAD use of panel or harness construction for linking segments of electrical control devices has made the requirement for free-cutting coppers mandatory. Screw machine shops are fabricating these connector components of various designs by the millions. Currently the most popular free-cutting coppers are leaded copper with conductivity of about 98% IACS, and tellurium and sulfur coppers at about 95% IACS. Some of these free-cutting coppers have residual oxygen and can become brittle or gassed under the usual conditions contributing to this phenomenon. All, however, can be obtained with a combination of deoxidizers or oxygen-free copper. In the case of the deoxidized variety, some slight sacrifice in conductivity will be noticed. Ordinary usage very seldom requires conductivity in excess of 90% IACS – and this presents no problem for these coppers.

ALL of these coppers can be cold worked without too much trouble. They can be supplied in a suitable wire temper for cold heading and secondary operations designed around the basic alloy system. Up to now there has not been too much interest in these alloys for wire forming or heading operations. Close dimensional tolerances may be the reason for the reluctance of the heading people to get into the electrical connector business. Alloys are available with the ductility and mechanical properties necessary for this type of forming. It would appear that some of the products could be made more economically by cold-heading or wire-forming operations.

RECENT TRENDS have also affected the old brass and copper reliables. There can't be any product more prosaic than free-cutting brass rod; it is the cheapest of such commodities and at one time was the easiest to process—all one had to do was to extrude, draw to finish dimensions, and ship. In many cases this practice won't work today. Deep drilling, roll threading, knurling, staking, slotting, etc., have complicated the picture, but the latest efforts of the screw machine builders have laid this ghost to rest. We now hear of beta-free rod for close tolerances on deep-drilling applications. Similar grain structures, but not necessarily the same temper, are required for roll threading, knurling and staking or whenever extra ductility is needed. Along with the consideration of grain structure, it has been necessary to take advantage of the broad chemical composition range for free-cutting brass. Most suppliers divide the standard range into two parts, utilizing the lower copper range for the larger sizes that will normally be machined on the heavier, faster screw machines where chip breaking and clearing the tools are the most important considerations. This might be considered the rough, breakdown type of stock.

FOR the smaller diameters, specialization has been the watchword. Depending on specific needs, you can now obtain free-cutting brass rod with all-alpha, fine-grained structure or an alpha-beta fine-grained extruded structure, or possibly a combination of both. For certain applications you might need a coarse-grained, all-alpha structure. Lead dispersion and lead content are other variables that can and will be controlled to meet fabricating or end-use requirements.

IN the cold-heading industry, advantage is being taken of the wider selection of copper and copper alloys that is available today. The nickel silvers, phosphor bronzes, and silicon bronzes combine good ductility and high strength with excellent corrosion resistance. The whole range of common brasses has specific applications and can be tailored to various heading operations.

The research and development hopper is full of interesting new ideas and projects at The American Brass Company. It could be that we're working on something which would help solve one of your problems. Even though we don't have the complete answer, perhaps we could both reach a solution faster by pooling our efforts. Call your American Brass representative and talk it over with him or write: Manager, Market Planning, The American Brass Company, Waterbury 20, Conn. 6020

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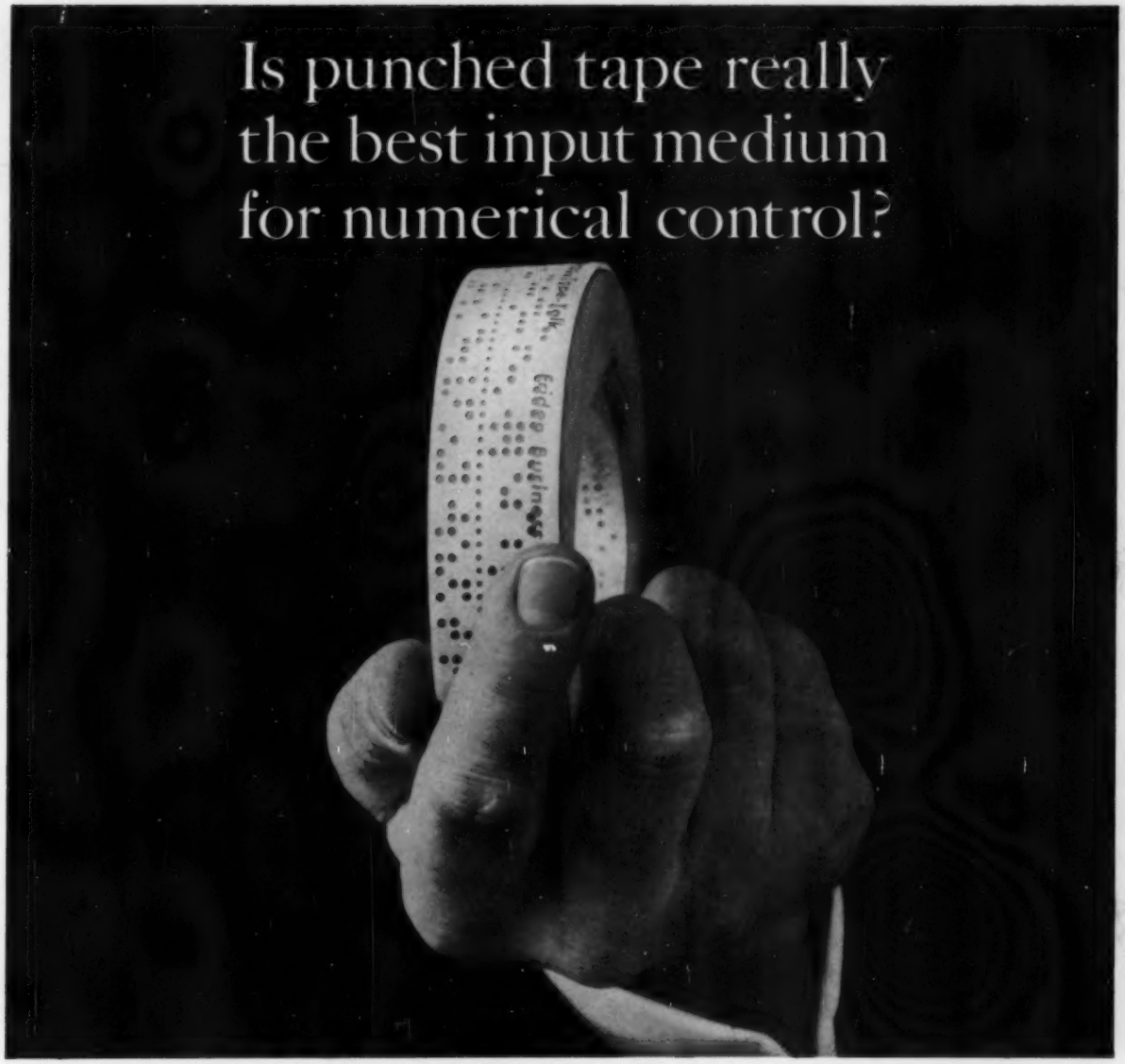
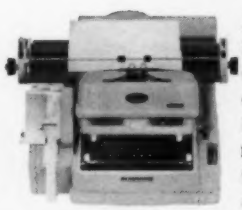
Is punched tape really the best input medium for numerical control?



(3 out of 4 machine tool makers say yes!)



Although 8-channel punched paper tape is only one of several numerical control input media, it is fast becoming the standard. Better than three-quarters of all builders of numerically-controlled machine tools now offer punched paper tape control. Why the swing to punched paper tape? There are three fundamental reasons:

1) Paper tape coding is visible, tangible. You can see it, touch it, and with practice even read it.
2) Paper tape is continuous. Unlike cards, it can't get out of order.
3) Paper tape is easy to program—preparation, verification, and reproduction of tapes are all handled on one inexpensive machine, the Friden Flexowriter® (illustrated).

For the machine tool buyer, standardization on paper tape means great savings. It's so much easier (and less expensive) when *one* input system can control *all* of the numerically-controlled machines in a given plant.

If you're thinking numerical control, you'll be way ahead to think *punched paper tape.*

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AT BLACK & DECKER

Jalcase 100 Cold Finished Bars Speed Tool Parts Production 50%

Here's what happened when Black & Decker Manufacturing Co., Towson, Maryland, switched from alloy grades 4140 and 8620 to J&L Jalcase 100 cold finished bar steel in the production of shafts, gears and pinions for portable electric tools:

- The free machining quality of Jalcase speeded production on automatic screw machines 50%.
- The uniform machinability of high strength Jalcase eliminated ½ hour per shift from machine downtime for tool changes.
- The strength and hardness of Jalcase have practically eliminated the need for subsequent heat treating and resultant part distortion.
- The combination of these production economies plus the lower initial cost of Jalcase over alloy grade steel has greatly reduced parts costs.

The free machining qualities of J&L Jalcase 100 plus its high strength, hardness and stabilized stresses make it an ideal cold finished bar steel for producing high quality machined parts for the metalworking industries.

Jalcase 100 has a minimum yield strength of 105,000 psi in round bar sizes to 1½" diameter and a minimum yield strength of 100,000 psi in sizes to 3½" diameter.

Jalcase 100 has a minimum hardness of 248 Brinell up to 1½" and 241 Brinell for larger sizes. It is also available with a lead addition, designated as Jalcase 100-L, for applications requiring superior machinability.

For literature write direct to *Jones & Laughlin Steel Corporation, Department 480, 3 Gateway Center, Pittsburgh 30, Pennsylvania.*

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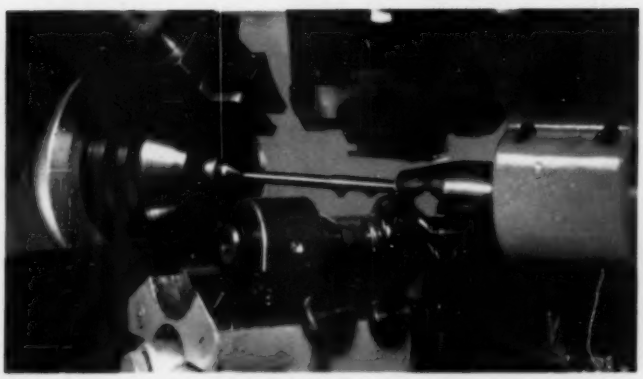
Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA

Where cold rolled steels originated in 1859

Black & Decker relies on a great variety of J&L bar stock. Over 30 electric tool parts are made from Jalcase 100 alone.

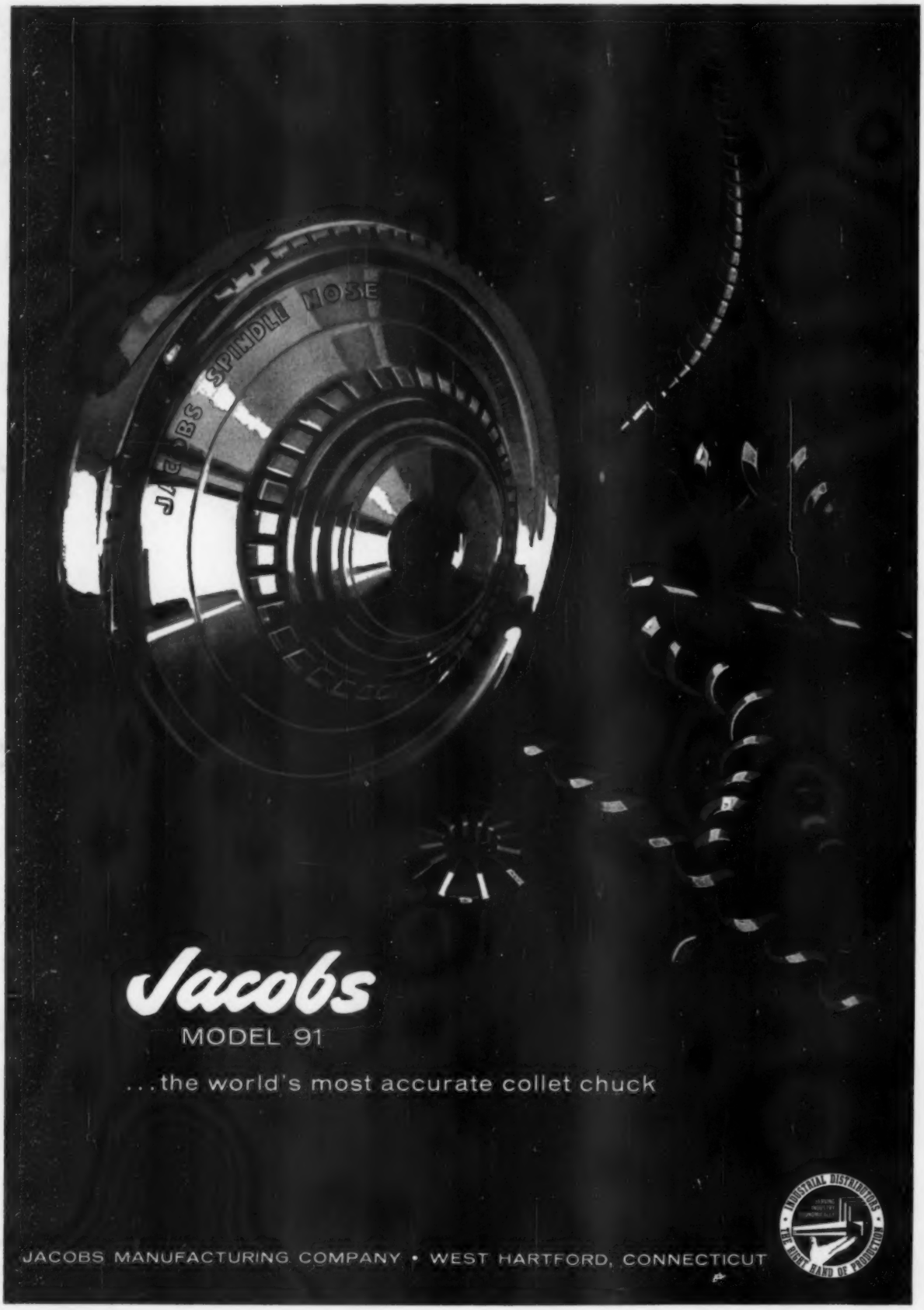
Made from Jalcase 100, these armature shafts are used in Black & Decker's ¼" Portable Electric Utility Drill.



▲ Black & Decker hobs pinion gears made of Jalcase 100 to tolerances of less than .001".

◀ Palletized trays transport a few of the many B&D machined parts that are made from J&L bar stock.

J&L STEEL



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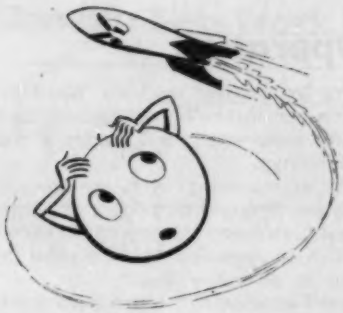
Talking Shop...



Nomenclature

WE'VE ALL HEARD of the anti-missile missile, which is a missile used to shoot down attacking missiles. Now they are talking about letting missiles carry a small missile to shoot down the anti-missile missile. This would apparently have to be called an anti-anti-missile missile missile.

Insecure?

THE SUMMER SCENE in New York was graced last month by the British Exhibition. Just after reading the page proofs of "Britain—Land of insecure prosperity" (*AM/MM*—June 27 '60, p99), we went up to see for ourselves some of the products our London editors had been describing.

There was nothing that looked insecure about the industrial displays. Two things struck us—the way the British manage today to produce products with a clean, modern look that somehow preserves a bit of no-nonsense utility; and the way they manage to describe these products with adjectives so strong no American would dare apply them to his product, yet with such an air of reserve in voicing them that the listener doesn't object—not at the time anyway.

Quality Reminder

MOST METALWORKING PLANTS these days boast a wide variety of shirts as the order of the day, including sport shirts, bowling league shirts, old Army shirts, and sweat shirts. At Edward Valves in East Chicago, company-sponsored shirts have been introduced. Each shirt carries a bold "Quality Always" slogan in script across the back with a small company insignia below. The shirts add to the impact of posters plugging the quality theme throughout the plant. David MacGregor, manufacturing manager at Edwards, puts his tongue in his cheek and says "our 'Quality Always' message gets closer to our people."

Breakdown Advice

AN AMUSING FOLDER has been published by a machine-tool distributor, offering suggestions to the superintendent when a machine tool breaks down. The temporary relief kit pictures such items as a bottle of bourbon for breakdown of American-made machines and a bottle of Scotch for foreign-tool breakdowns. There are mild proposals such as aspirin and tranquilizers, and stronger remedies such as dynamite ("Be sure your district is zoned for use of dynamite") and revolvers (handy for getting your message across to your associates). The kit also includes a telephone to call for help. The entertaining booklet is published by Harron, Rickard, & McCone Co of Northern California, so you can probably guess whose number you are supposed to call. After the fun is over, the booklet gets down to serious advice on the factors to consider in deciding whether to repair, to rebuild, or to replace.

Drillpress on Stamp

A DRILLPRESS will appear on a special 4¢ stamp that will be placed on sale on August 28. The stamp is not in honor of the Machine Tool Exposition opening a week later, but is to coincide with the Eighth World Congress of the International Society for the Welfare of Cripples. The stamp will show a man confined to a wheelchair operating a drillpress. Those metalworking managers who have tried handicapped workers know how practical the scene is. The handicapped usually make unusually productive and consistent workers.

Bake Tools After Plating

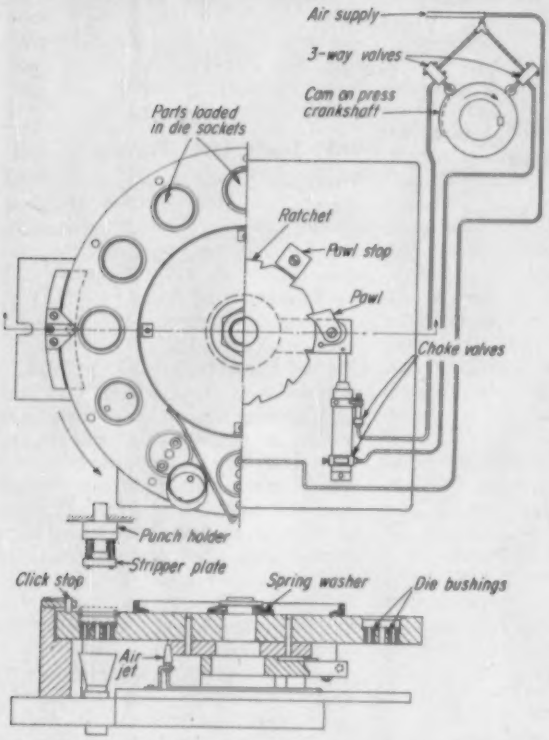
THERE ARE THREE REASONS why tools are electroplated with chromium or nickel: (1) salvage, by regaining worn dimensions, or correcting mechanical errors (2) decoration (3) to resist wear or metal pickup.

Although electroplating of hardened tools is relatively simple, it can be hazardous if the plating is not followed by baking (tempering). During deposition of the plated metal, a considerable amount of hydrogen also is deposited on the tool. Some of this hydrogen diffuses into the tool. This causes extreme brittleness, so that if the tool is used immediately after plating, breakage in service may occur.

To avoid such an occurrence, say tool-steel engineers at Bethlehem Steel Co, bake the tool at 300-400 F for at least four hours, to restore its original ductility. Baking should begin as soon as possible after plating. Grinding should never be done on the steel itself prior to baking. If baking is omitted, the tool will gradually recover its ductility at room temperature in from two to three weeks. It will be subject to breakage if used before the recovery has been completed.

Practical Ideas...

Merry-Go-Round Die Speeds Secondary Operation



A simple operation on a small part piece which has to be performed as a secondary step can amount to considerable loss of time by standard methods. When the number of such parts run in five or six figures, there is definitely a call for some sort of automation if cost is to be kept to a minimum.

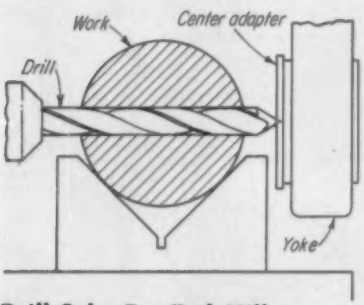
This was our way or reasoning when we recently had to pierce two holes through the bottom of a cap-shaped part. As a result, the merry-go-round die shown was constructed which, in operation, loads, pierces the part, and discharges it, all automatically.

A vibratory hopper (not shown) feeds the parts into each of the twelve die sockets as the indexing table rotates past its location on the right. The parts are thus seated and pierced as they reach the piercing station at left. Here a block, shaped to the radius of the index table with a close fit under it, provides the necessary support during the piercing operation. It also carries a click stop for positive positioning. A funnel situated under the table at this point catches the slugs as they pass through the hardened die bushings in the sockets. The piercing punches are mounted, complete with a spring-loaded stripper plate, on a simple punch holder secured directly to the ram.

As the table is further indexed, (two stops to be exact) the finished part is popped out of the socket by an air jet aimed through its center hole. A fence then sweeps the part from the table into a tote pan.

Automatic indexing is achieved by a cam-controlled pawl and ratchet arrangement. The cam, being mounted on the press crank shaft, activates two 3-way valves which control the air flow to an air cylinder. A choke valve at each end intake of the cylinder insures smooth, shockless indexing as the piston pushes the pawl to a stop and returns.

Hjalmar Dahl, Upplands Vasby, Sweden



Drill Subs For End Mill

A recent job called for slots to be milled accurately through the center of workpieces too large for our available end mills. This was quite a challenge since the finish had to be good, making it necessary to take the final cut in one pass, and as milling was the only possible method by which the job could be done satisfactorily.

However, we found an efficient solution to our predicament by employing a standard drill modified to size the slot in a single cut. After rough milling the slot to half depth, leaving 0.010 in. top and bottom for the finishing cut, the piece was rotated 180° and similarly roughed out. This gave us a slot through the piece 0.020 in. undersize. Our first step in modifying the drill was to grind a concentric 60° point on the cutting end. This served to support the outer end of the drill during the milling operation and also to maintain concentricity while grinding the flutes to size. After the desired diameter had been reached, the flutes were relieved to provide cutting edges. To enable the drill entering the undersize slot, short reliefs were ground on the ends of the flutes.

Once the drill had fully projected through the workpiece, the yoke was adjusted so the adapter mounted in it could accept the point of the drill. This left only the actual milling which was done with one pass to size and good finish.

Edward V Quinn, Philadelphia, Pa

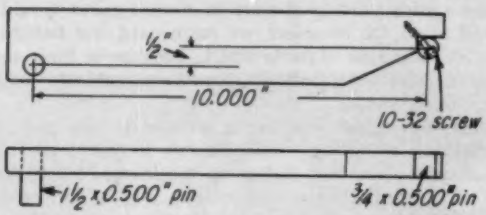
Make Your Own Thin Nuts

When space doesn't permit use of standard nuts, for small-fractional or number-size screws, you can make dependable ones from sheet metal. After cutting squares of the metal, punch holes through the centers with a tapered punch and tap the holes to fit the screws.

Punching instead of drilling the holes flares the metal enough on the back side to provide stock for longer threads. In assembly, the screws must be entered from the side the holes were punched.

H Josephs, Gardenville, Penna

Sine Bar Sets Work for Angular Grinding



Bulky machine parts and large die sections are sometimes difficult enough to handle on the surface-grinder table, but when they have to be set up for angular grinding the job is even tougher. Regular sine bars are then usually inadequate, and angle plates only add to the bulkyness. This is why I made up a sine bar to permit the work to be mounted directly on the magnetic chuck and then using a side-grinding or cup wheel to grind the angle.

This sine bar is made of ground stock ¾ in. thick, 2 in. wide, and 12 in. long. A ½-in. hole, drilled and reamed 1 in. from one end and 0.500 in. off center, carries one of the gaging pins. At the other end, the second pin is secured with a capscrew in a step ground to locate it precisely 10 in. from the first and in center of the bar.

The reason for the axial difference of ½ in. in the pin locations is that we use opposite sides of the pins in setting the angle instead of both bottom edges as is normally done. Both pins are hardened and ground to 0.500 in. dia, the one in the reamed hole being 1½ in. long and is mounted to project on one side while the pin in the step is ¾ in. long and ground flush with the sides of the bar after securing.

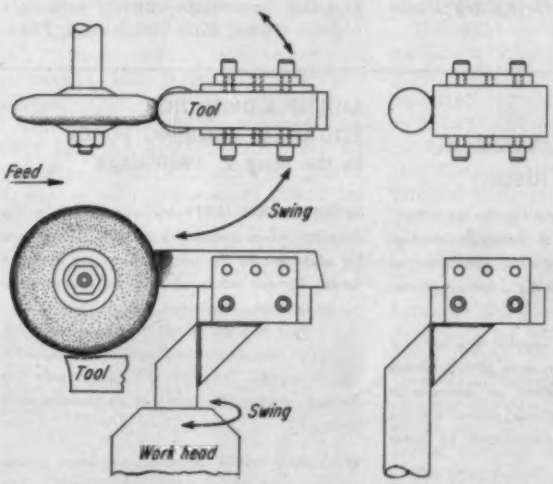
To insure accuracy I took a grinding cut over the top edge of the bar after placing it on gage blocks; a ½-in. block under the projecting pin and a 1-in. block under the short one. I haven't hardened the bar for fear of distorting it, but have found it to stand up well after years of use.

The first step in applying the sine bar is to make sure that at least one edge of the magnetic chuck is true to the travel of the table. Once this has been established, it will be your reference edge against which the projecting pin will rest as the sine bar lays on the table. The other pin is located from the same edge with the aid of gage blocks, micrometer depth gage, or vernier depth gage. I prefer the vernier gage because it's faster to use and just as accurate.

Distances for setting my gage are taken from the American Machinist Handbook's sine-bar tables and are doubled as these are given for 5-in. bars. When the sine bar has been located on the chuck, the reference edge of the work is eased up against the bar and the work secured.

J H Sperman, Brooklyn, NY

Tool-Grinder Fixture Simplifies Radius Grinding



The equipment furnished with conventional cutter-grinding machines especially the accessories required for radius grinding, is sometimes lacking in meeting certain tool requirements. One example of this is a fixture in which a tool bit may conveniently be ground to a convex or concave radius.

My answer to filling this gap is in the form of an L-shaped toolholder which mounts in the grinder's work head. It consists of a trough joined to a 1 in. x 6 in. drill rod by means of a gusset and welding. It may be used in all types of revolving or indexable work heads on any conventional tool-grinding machine.

After inserting the tool and holder in the work head, set the radius either on center or off center—convex or concave as required—and grind by rotating the work head over or under the grinding wheel. Stock-removal control is achieved by feeding the wheel into the work. The top of a radial angle can be ground by plunge swinging the tool into the grinding wheel.

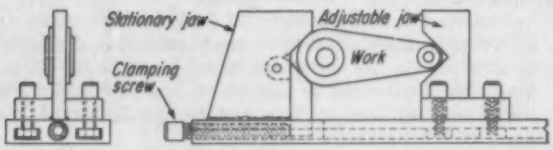
If all measurements for controlling the radii are taken from the centerline or—as in the case of a segment of a radius—from the side of the tool, this fixture will produce tools at a fast rate and at low cost while maintaining precision.

When welding the three parts together, the centerline of the trough must cross the axis of the 1-in. stem. It may, therefore, be desirable to leave the trough bottom oversize so it can be machined to accuracy. The sides of the trough are attached with capscrews, and the tool to be ground is held with headless setscrews through the side plates. I made the width of the trough wide enough to accept the largest tool we use. Narrower tools can then be centered by placing spacer plates of equal thicknesses on either side of the tool.

John J Zuber, tool grinder, General Electric Ordnance Dept, Pittsfield, Mass

Practical Ideas...

Fixture Speeds Straddle Milling



One of the most outstanding advantages of straddle milling lies in the fact that two, and sometimes more, sides can be finished with one pass of the cutters. However, associated with this type of machining is often the job of designing a workholder that will not interfere with the cutters.

We experienced this recently when a workholder had to made for a linkage whose two bosses required facing on both sides. End gripping the pieces in a double-V fixture solved the problem easily as the pieces had been held to close toleraces in production. And, as one of the jaws is adjustable, the fixture can take a wide variety of sizes in similar parts should the need arise. On occasion, we have used the fixture for milling one side of parts which, because of their shape, would have been difficult if not impossible to hold by any other means.

The stationary jaw, being welded to the base, provides the clamping force. This is in the form of an L-shaped piece that makes up the lower half of the V. It pivots near the center of the jaw when pressure is applied by a screw entered from the end of the base. The motion necessary to clamp a workpiece is relatively small once the adjustable jaw has been located and secured.

Four socket-head capscrews, engaging T-nuts in the base, secures the adjustable jaw. It is kept in alignment by a key on the underside of the jaw which has a sliding fit in keyway in the base. Serrating the jaw faces before hardening improves their gripping ability.

E. M. Bladholm, Huntington Park, Calif

Rod Forms Radius on Grinding Wheel

Many simple forms, such as concave radii, can be crushed into grinding wheels in lieu of specialized equipment. The photo shows a setup where a radius is being formed in the periphery of a wheel, using a length of drill rod secured to the magnetic chuck. Other forms can also be shaped in the same way, many of which could be difficult to produce with a dresser.

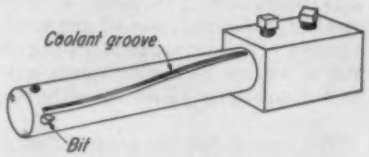
The crushing procedure is simple. After selecting a rod sufficiently long to cover the entire circumference of the wheel, it is placed on the chuck and precisely aligned with the travel of the table. Blocking is then snugged up against both sides of the rod and the magnet is turned on.

While bringing the wheel into contact with the rod, the hand wheel is used to shuttle the table back and forth. Downfeed is increased by four or five thousandths on each pass and repeated passes are made until the desired depth of form is reached. It should be pointed out that the wheel must be of vitrified bond, preferably one of the softer grades. And, is it necessary to say that the grinder motor is *not* turned on during the crushing process?

H. J. Gerber, Stillwater, Okla.

Boring Bar Carries Coolant

Very often, the finish of a piece or proper function of a cutting tool depends on constant application of coolant. The question is, then, how do you maintain a steady flow of coolant to a toolbit during deep-hole boring?



I solved this problem by milling a slightly helical groove on the OD of the bar from the back end to just above the toolbit. Now, when the coolant is applied at the bar holder the groove carries it to the toolbit and the immediate cutting area.

Stan Clark, East Bradenton, Fla

Hjalmar Dahl Upplands Vasby, Sweden Won $25 for his idea:

MULTIPLE-DRILL JIG EQUALIZES HOLDING FORCE in the May 2, 1960 issue

AN EXTRA $25 will be paid for the best Practical Idea in each issue of *American Machinist/Metalworking Manufacturing*. Selection of the winning idea is made by a group of our readers.

PAYMENT—in addition to regular rate for item published—will be made as soon as tabulations are completed. The winner or winners—in case of a tie when duplicate prizes will be awarded—will also be announced in these pages.

JUDGES . . . are a group of *American Machinist/Metalworking Manufacturing* readers who select articles they prefer in a particular issue. This group changes entirely with each issue and represents a true cross-section of our readers. Their decision is accepted by the editors, without reservations or bias, as final in each case.

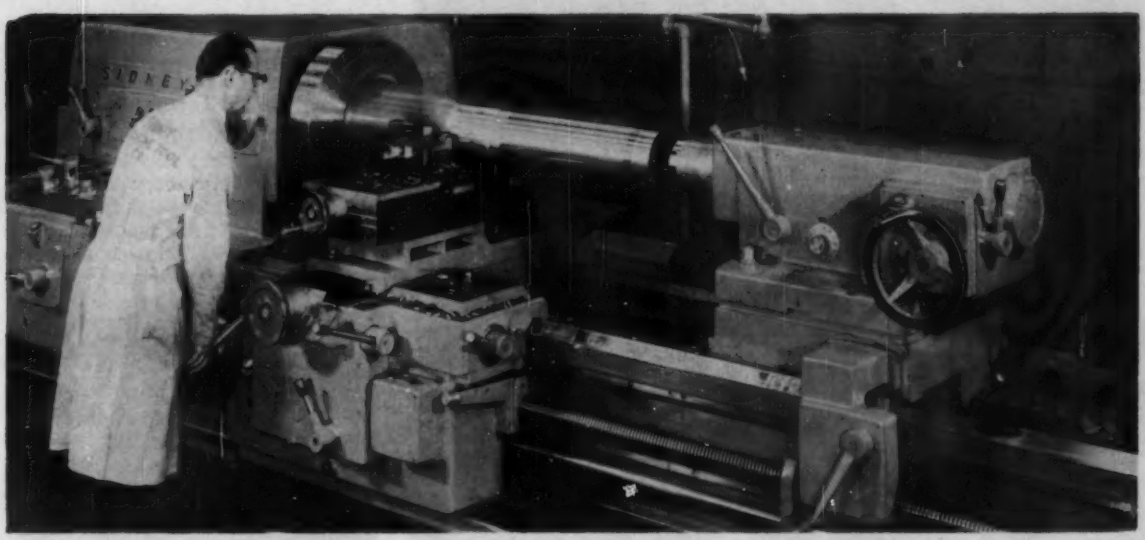
REQUIREMENTS—All items appearing in the Practical Ideas pages are eligible. They must be submitted by the originator on an exclusive basis. Do not worry about your shortcomings as an author, draftsman, or photographer—every item will be edited in accordance with *American Machinist/Metalworking Manufacturing* standards. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of McGraw-Hill Publishing Co. Inc, and those of its advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send all entries to: "Practical Ideas Editor" *American Machinist/Metalworking Manufacturing*, 330 West 42nd Street, New York 36, NY.

New Shop Equipment

Materials and Parts

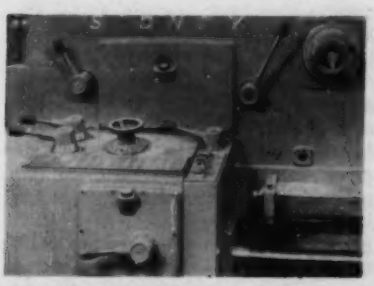


Sidney 75-hp Lathe Removes 180 Cubic Inches per Minute

Three completely redesigned lathes —available in eight models—were unveiled today by Sidney Machine Tool Co. Leading the new series is the Sidney 4025 (illustrated) which is a 75-hp extra-duty lathe capable of removing 180 cu in. of metal per minute.

In one operation (see cover) the 4025 cut SAE 6145 steel, RH 26C at 288 sfm, 0.0835 ipr, and 1 in. depth of cut—a rate in excess of 200 cu in. per min.

The lathe, which is completely new from the floor up, provides 36 spindle speeds and 75 hp in all speed ranges. A design improvement of the series is the control panel, located at convenient height for operator.



Simplified controls are located at convenient height. Headstock features 36 spindle speeds; gearbox has 60 threads and feeds.

The 4025 series is made in three models with swings over the bed of 40½, 45½, and 49 in. They are equipped throughout with anti-friction bearings and automatic lubrication to all parts. Other lathes in the line are the 3220 heavy duty lathe in three models, the 1307 10-in. lathe in one model, and the Spacemaster 7250 for missile and aircraft work.

Headstock of the 4025, which features 36 spindle speeds in geometric progression, has an overall speed ratio of 160 to 1. Gearbox has 60 threads and feeds. All final drives to spindle are through opposed helical gears and all cutting speeds are selected through a single dial control.

A simplified headstock shifting system enables operator to dial setting of either rpm or surface speed. Using the latter, he can dial work diameter instead of rpm and be assured of proper surface speed. Constant cutting speed can be maintained by using dc motor drive. Speed range for 4025 is 5-800 rpm.

With the opposed helix angle or final herringbone drive gears, the 4025 can achieve a 22 to 26 micro-in. finish. The manufacturer reports 12 micro-in. finish on various test billets.

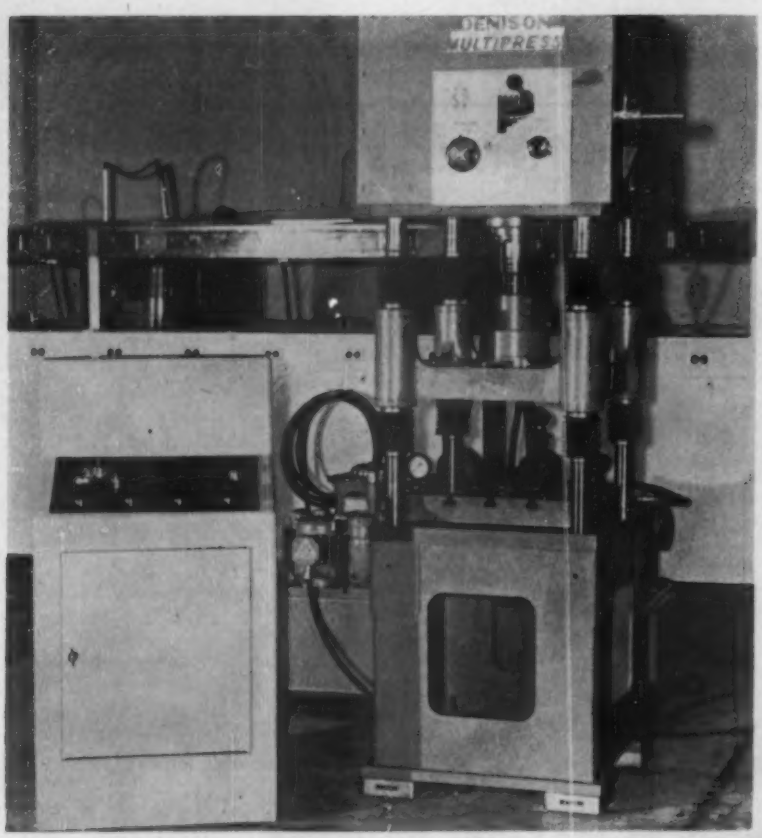
Machine's end gearing is totally enclosed in a cast housing and is automatically lubricated. End gearing is anti-friction and all gears (end and headstock) are hardened and shaved. A 1-to-1 end gear ratio makes possible quick and accurate conversion from conventional to metric leads.

Optional equipment includes complete tracer controls; European style tool rest; electric apron controls; steady and follow rests; taper attachment; length measuring device; dual cross feed and compound dials; and automatic length feed stops.

The one-piece beds, which range from 13 to 49 feet, have been given considerable rigidity to handle the torsional load of 75 hp. An alloyed cast iron corrugated truss incorporates chip-shed chutes and full depth walls.

Sidney Machine Tool Co, Sidney, Ohio

MORE DATA? Circle 51, inside back cover



Denison Press Blanks at 600 Strokes Per Minute, Has Remote Control Console

New 25-ton hydraulic press, which can deliver over 600 ram strokes per minute, features a separate electric console which may be positioned at any convenient point on the plant floor. It will be in operation—producing electric motor laminations, two per ram stroke, from 0.025 in. by 3 in. wide silicon steel stock—at the Machine Tool Exposition in Chicago, September 6-16.

An important feature of the new unit is that the number of ram strokes can be changed while the machine is cycling. Also, pressures can be changed while the machine is in operation. Any changes in the ram stroke automatically sequence feed control through a servo-loop system.

Designed for high speed progressive stamping operations with progressive dies, the unit is a vertical frame, four-column design platen press, equipped with a Littell No. 3-6½ roll feed, stock oiler, and variable speed straightener. Bed area between guide posts is 20x20 in. A variety of optional bed bolster plates are available. Daylight area is 13 in. and can be adjusted mechanically — with a screw thread—a total of 3 in.

All speeds and pressure adjustments are controlled electrically, so that instantaneous shifts can be made while press is in operation. All controls—speed, pressure, single cycle, auto cycle, inching, setup, and emergency stop—are on the separate console panel, which will soon house electronic timers and counters.

Press contains a closed circuit hydraulic system, servo drive, and harmonic cam drives for work strokes of ¼, ½, ¾, 1, 1½, 2, and 3 in. Cams can be varied to permit special work strokes.

To further provide a unit which will hold plant noise levels as low as possible, Denison has shock mounted both the press frame and power unit.

Punch breakthrough is adjustable and controlled without positive stops. Range of punch breakthrough adjustment is 1 in., in increments of 0.001 in. Elimination of positive stops also reduces noise levels while machine is in operation. Inching and setup controls for ram and feed can be operated either simultaneously or separately.

Although maximum cycle speed at present is over 600 strokes per min, substantially higher speeds can be attained by increasing horsepower and pump capacity.

Denison Engineering Div, American Brake Shoe Co, Columbus, Ohio

MORE DATA? Circle 52, inside back cover

New Bandsaw Blades Offered For High-Speed Ferrous Cutoff

Ultra HSS metal cutting bandsaws are designed for heavy-feed, high-speed production cutoff work on ferrous metals. These welded-to-length blades, reported to be the result of a new metallurgical approach, are said to feature harder teeth, tougher bodies, and more uniform full-blade flexibility, adding up to 300% longer life. They are available in all standard widths, thicknesses, and tooth spacings.

Heller Tool Co, Newcomerstown, Ohio

MORE DATA? Circle 53, inside back cover

GE Push Button Line Reduces Panel Space Requirements 40%

Because of their smaller size—about half that of existing heavy duty industrial push buttons—the new units may be mounted as close as 1¼ in. apart. Heavy duty units need to be separated by at least 2¼ in.

In spite of the size reduction, GE offers the new oil-tight miniature line in all operating and functional forms now available. These include push buttons (with or without guard); mushroom head buttons; selector switches; illuminated push buttons; illuminated mushroom-head buttons; transformer-type indicating lights; and push-to-test indicating lights.

Pressure type terminations—new in industrial oil-tight push button

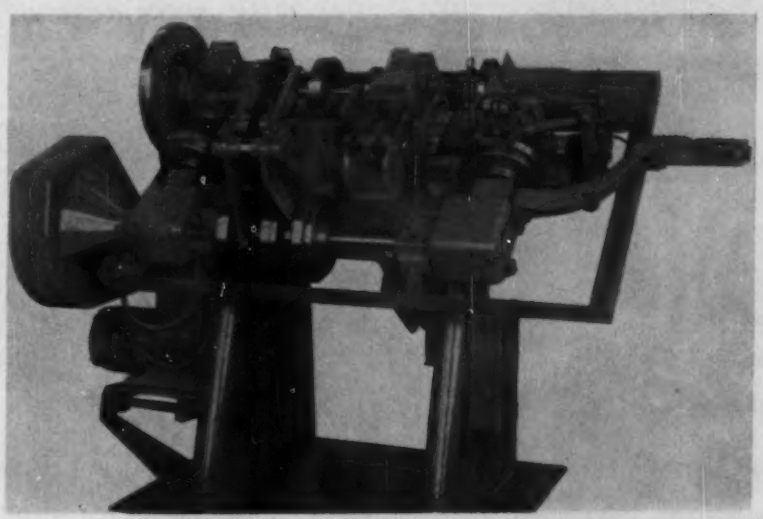
terminal design—are provided for push-on connectors. These terminations assure positive and trouble-free connections, according to company.

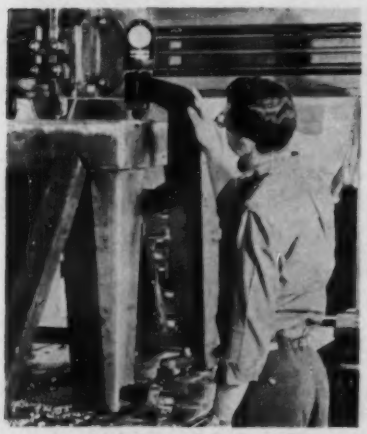
Line includes six different colored retaining rings to permit easy changes in color coding; illuminated forms come in six colors. A wide variety of engraved or blank nameplates are available in two sizes.

All units are oil-tight and suitable for use where cutting fluids and coolants are present (Line meets applicable standards of NEMA, NMTBA, and JIC for oil-tight push buttons.); special synthetic rubber seals and washers keep out oil and other foreign materials.

General Electric Co, Schenectady 5, N Y

MORE DATA? Circle 54, inside back cover





Portable Hardness Tester Designed For Large, Bulky Metal Components

Mobile Tester, a direct-reading unit for conducting Rockwell hardness tests, consists of a clamping device—C-clamps with varying throats—and an indenter head. Unit's major and minor test loads are produced by springs which are preloaded and contained in an individual spring sleeve. Complete spring units are interchangeable for different load ranges.

Model M-I gives readings in the R_c scale with distance between anvil and penetrator of 0 to 6.3 in. with depth of throat of 3.3 in. Weight is 17 lb. Model M-II gives readings in R_c scale with distance between anvil and penetrator of 0 to 9.8 in. with depth of throat of 5.1 in. Weight is 18 lb. Accessories such as calibrated kilogram weights for conducting Rockwell A and B scale tests are available as optional.

Wilson Mechanical Instrument Div, American Chain & Cable Co, 989 Connecticut Ave, Bridgeport 2, Conn

MORE DATA? Circle 55, inside back cover

Baird Inclinable Four-Slide Machine Operates at Any Angle between 0-90°

Model RWI-1, which will be shown at Machine Tool Exposition, gives high-speed production of stamped and formed parts from ribbon metal or wire stock while operating at any angle between horizontal and vertical. Because of this inclinability, the machine saves time in tool setup, maintenance, workpiece handling.

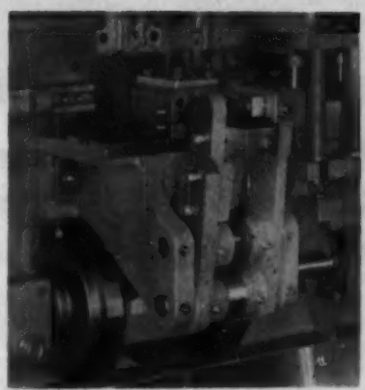
Since the entire frame pivots, machine can be used like an inclinable press—for easy work ejection by gravity. Tooling is relatively simple.

Model RWI-1 is rated as a No. 1 and will take tooling made for older non-inclinable machines of the same type. However, it will accept feed lengths up to 8½ in., 1½ in. ribbon metal stock, or 3/32 in. dia mild steel wire.

Forming slides have ½-ton capacity. The press unit, which is rated at four tons, is symmetrical. Therefore it can be mounted on either side of the metal line. Hence, burr ends on finished parts can be placed where desired. Two units can be mounted on each machine, and die sets can be used.

Operating speeds of 75-300 strokes per min are available at normal speed with a variable speed drive. Production can be increased to 400 parts per min by incorporating high speed cams and short feed. Machine can be tied in with automatic equipment to receive, form, and eject a part without restriction. This is possible because of its operating position.

An all new form bracket gives two vertical forming motions in place of the usual one. Form bracket can be mounted in the normal rear position or at side of machine.



Symmetrical press unit, rated at four tons, mounts on either side—front or back—of work. Therefore, the burr can be put on either side of stock.

The Baird Machine Co, 1700 Stratford Ave, Stratford, Conn

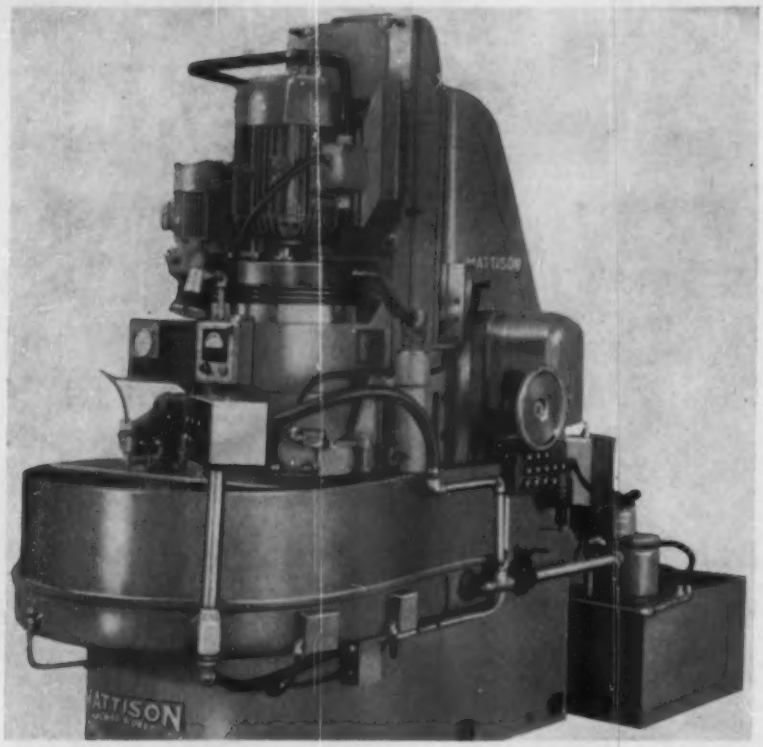
MORE DATA? Circle 56, inside back cover

Hanson-Whitney Taps Feature Non-Brittle Surface Finish

Process developed during last six months gives Hi-Spi taps a hard, black finish, free from the brittleness so often found in surface hardening treatments. Taps, which have a steep spiral flute, provide positive chip removal, and reportedly have greater torque strength.

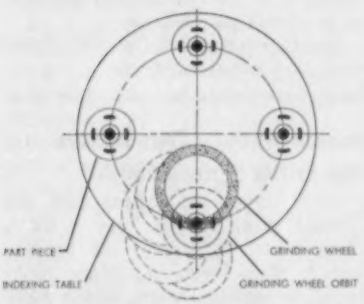
Hanson-Whitney Co, Hartford, Conn

MORE DATA? Circle 57, inside back cover



Mattison Rotary Surface Grinder Orbits Over Work Held Stationary in Fixture

The piecepart in this surface grinder remains in a fixed and indexed position while the wheel axis revolves around its center—instead of spinning under a stationary spindle. End results are very similar to those of conventional vertical-spindle rotary surface grinders, but costs are reduced. A flatness tolerance of 0.0005 in. is maintained at production rate of 140 parts per hr with stock removal of 0.004 in. in a typical application.



Sketch shows path of wheel as the planetary head spindle orbits around center of workpiece at 60 rpm, approximately same speed at which work would rotate on conventional vertical-spindle machine.

This new method of grinding has three economic advantages:

- Holding the piecepart stationary in its fixture keeps it accurately oriented. Thus, it is easy to load, transfer, and unload the part without danger of mislocation.
- Equipment costs are reduced because fewer mechanical parts are needed to revolve the spindle than to provide three separate drives for spinning the work.
- **Continuous cutting, with index-type work table, increases machine utilization and permits very high production rates.**

Another advantage, while grinding thin parts which spring under a heavy cut, is that the planetary face-type wheel covers work surface area evenly, thereby reducing pressures on any one section.

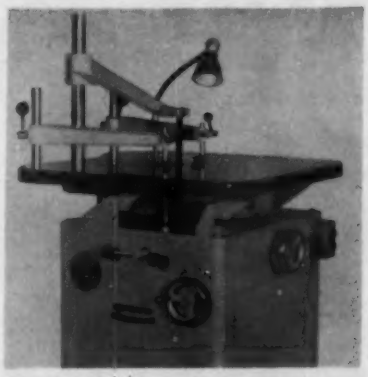
These machines are designed to take advantage of self-dressing wheels. Once the wheel has been trued during initial setup, wear takes place evenly so that perfect flatness results. A post-process gaging system actuates an independent automatic feed for controlling size.

This planetary head principle not only is suited to high-production surface grinding on conventional-type vertical-spindle machines, but also permits combinations of grinding with drilling, boring, reaming, and tapping. Because the work is held in stationary fixtures or chucks, it is always oriented for other stations in an index-type, around-the-table, or transfer-type machine requiring either vertical, horizontal, or angular mounting of heads.

Mattison is now building both standard machines (as illustrated) and special, automatic equipment with either single- or double-spindle planetary heads.

Mattison Machine Works, Rockford, Ill.

MORE DATA? Circle 58, inside back cover



Rice Introduces Die Maker Line For Filing, Sawing, and Lapping

Model PDM (illustrated) has a stroke variable from 0-5 in., with speed variation from 80-350 strokes per minute. Its table tilts 15° right or left, stroke mechanism tilts 15° to the rear.

The new line, obtainable in bench and floor models, is available in two speeds, four speeds, and infinitely variable speeds from 100 to 475 strokes per minute. All models available with infinitely variable strokes from 0-5 in., and all others have 15° four-way tilting tables.

Rice Pump & Machine Company, Belgium, Wis

MORE DATA? Circle 59, inside back cover

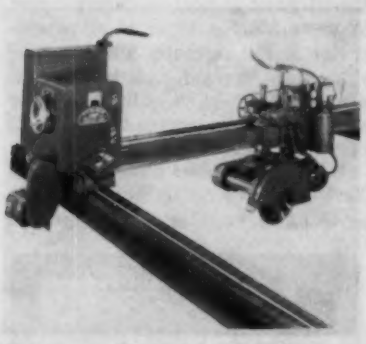
Automatic Device Protects Operator of Power Machinery

Protectomatic Control is designed to eliminate possibility of accidental injury. Used to control operation of punch presses, power shears, molding presses, it permits operation by any one of five methods: foot switch;

one-hand non-automatic; one-hand automatic; two-hand non-automatic; and two-hand automatic. Method is chosen by turning a selector knob located inside the control box. Device can be easily added to existing equipment. Shipped in a kit with instructions for installation on any machine, it is priced at $194.50 f.o.b.

Protectomatic Inc, 708 42nd Ave North, Minneapolis 12, Minn

MORE DATA? Circle 60, inside back cover



Aluminum Plate Saw Handles Stock 10 Ft Wide, 2 In. Thick

Designated the 111CX, new 15 hp saw produces accurate square rectangles up to any length, and up to ten feet wide, from stock up to two inches thick.

Saw consists of a motor and blade arbor which travels on a transverse rail, which in turn moves along two side rails. This four-way movement in combination with 90° swivel head, permits trimming all four sides of a plate without moving it. This reduces handling to a minimum.

A V-belt drive provides various proper speeds for different alloys. Saw's integral spray-mist cooling-system is air operated.

Ty-Sa-Man Machine Co, 1001 White Ave, Knoxville, Tenn

MORE DATA? Circle 61, inside back cover

Electron Beam Vaporizer Unit Rated at 250ma, Operates on 120v

An electron beam evaporating unit capable of vaporizing all metals including those having the highest melting points such as tungsten, tantalum, Niobium (columbium), and molybdenum is now available as a standard product.

A packaged unit, Model EBV-3 includes a specially-designed electron beam gun, extra filaments, power supply, control panel, and electrical feed-throughs. It is rated at 250 ma at 10 KV and operates on standard 120 v, 60 c, ac, 15 amp power. Price of the standard unit, including field engineering service to assist in installation and demonstration of proper operation, is $4,500.

Alloyd Corp, 85 Cambridge Parkway, Cambridge 42, Mass

MORE DATA? Circle 62, inside back cover

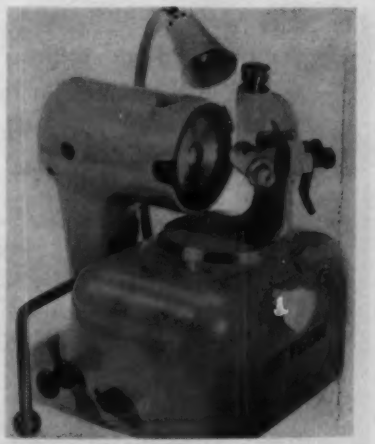
Barrel Finishing Unit Features Compound Separation System

Model XLC-2120 has hexagonal barrel 20 in. in diameter, 21 in. long, and lined with ¼ in. thick neoprene. Beneath the barrel is a unique work and compound separation system. Top tank screen retains work while the barrel is unloaded.

Based on manufacturers' individual needs, the barrel is supplied unlined or with abrasive resistant rubber. Unit can be utilized for wet or dry processes. Barrels are supplied with two types of drives. One involves constant speed, and the other is variable in a ratio of 10:1.

Tumb-L-Matic, Inc, St Mary's St, Stamford, Conn

MORE DATA? Circle 63, inside back cover



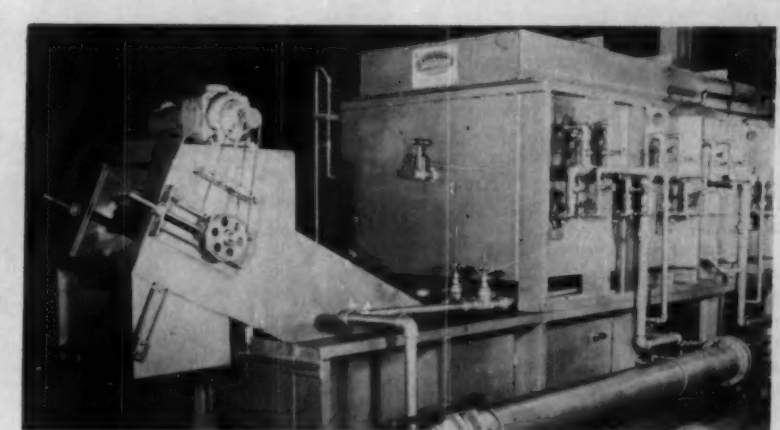
Twist Drill Grinder Handles Tools up to 6¼ in. Long

Swiss-made KBS-6 Meteor sharpens milling cutters and RH and LH twist drills from 0.008 to 0.236 in. in dia and up to 6¼ in. long. Point angle is adjustable from 90-180°, relieving is adjustable from 0-20°, and a four-jaw chuck allows tool to be clamped instantly. Unit weighs 37½ lb, occupies bench-top space of 13 x 10 x 15½ in. Drive motor operates on any standard 110-v 60-c power source.

Standard equipment includes a 20-power magnifying glass, dressing diamond, adjustable side stop for flat drill grinding, grinding ring, and lamp with transformer. Price is $486.50 fob New York.

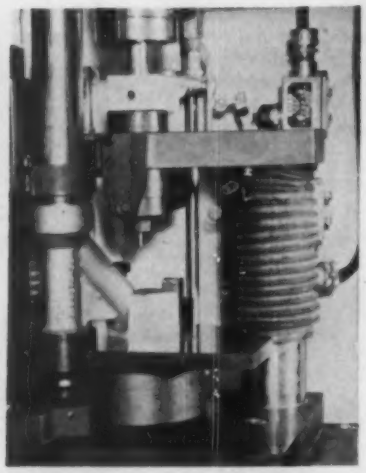
Dist by Associated American Winding Machinery Inc, 750 St Ann's Ave, New York 56, NY

MORE DATA? Circle 64, inside back cover



SUFFLE HEARTH FURNACE, designed for automatic, continuous atmosphere heat treating and quenching, also hardens and carbo-nitrides within range of 1400-1900F. Especially adaptable to processing small parts such as fasteners, nails, and bearing parts, it comes in various sizes which will process 50-1200 lb an hr—*Sunbeam Equipment Corp, 180 Mercer St, Meadville, Pa*

MORE DATA? Circle 65, inside back cover



Denison Multi-Compaction Press Aids Production of Electronic Components

Automatic hydraulic press—specifically designed for the compaction of powdered metals, glass, and plastics—increases anode production by five times or more. A one-ton production model, which was tooled especially for volume production of tantalum capacitor anodes, will be on display at Machine Tool Exposition in Chicago September 6-16.

With only slight tooling modifications the press can be adapted to a variety of powdered metal compaction operations—including operations with ferrous, non-ferrous, and the exotic metals.

Press is a completely enclosed unit with transparent plastic panel screening the tooling area. Tantalum wire is fed from a spool at top of press. It runs, in turn, through a straightener, an adjustable wire feeder, and the hollow ram to cutoff mechanism and upper compacting punch.

The wire is cut to its pre-set length inside the hollow top ram immediately before the wire is placed in the anode.

Tantalum powder is placed in die cavity through mechanically actuated horn feed (see close-up illustration) which is synchronized with action of the top ram. The sweeping action of horn also pushes ejected compaction clear of die cavity.

Cycle time is 25 per minute (as compared to 4 or 5 in former methods which required die cavity to be hand filled by an operator) and higher speeds are possible with proper powder control. Maximum fill capacity of die is 1¼ in. compacted with diameters from 0.040-0.375 in. Future models in series will make compactions of larger diameters. Wire diameters may range from 0.016-0.025 in.

Press holds length variations to tolerances of 0.005 in. and density variations to 1% of specifications. Wire feed mechanism will feed 1 in. max length of wire per stroke with ¼ in. adjustment. Unit can be run either single or auto cycle, but is designed primarily to operate untended as an automatic production tool.

Denison Engineering Div, American Brake Shoe Co, Columbus, Ohio

MORE DATA? Circle 73, inside back cover

New Circuits Added To Missing Parts Detector

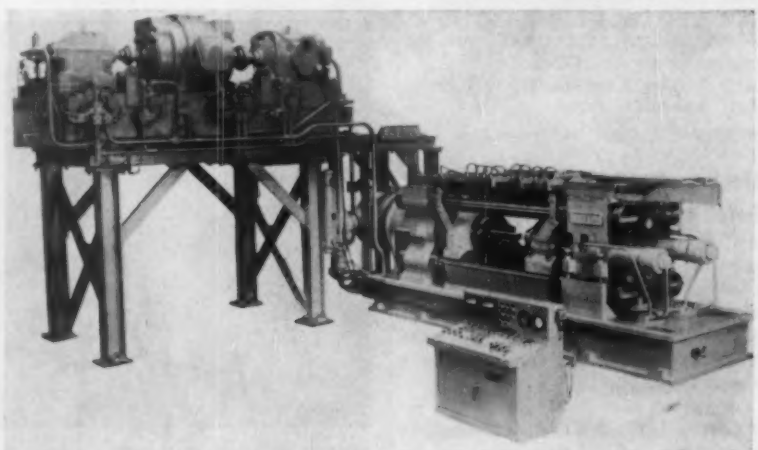
Additions to the Circuit Master Missing Parts Detector (*AM*—Mar 23, '59, P182) provide further automatic protection against machine breakdowns and die damage. New yellow circuit, with associated detection devices, stops a power machine if circuit is grounded. New red circuit stops machine in case there is an unintentional break from ground. Visual reset indicators incorporated in these 520 Series units allow operator to tell instantly whether machine has stopped due to detector action (mis-feed, buckling, etc), or whether there is trouble in machine's operating circuitry.

Wintriss Inc, 20 Vandam St, New York 13, NY

MORE DATA? Circle 66, inside back cover

Ex-Cell-O Machine Bores 22 Holes in Two Setups

Boring machine, smallest in the range produced by the company, can bore a total of 22 holes in a small



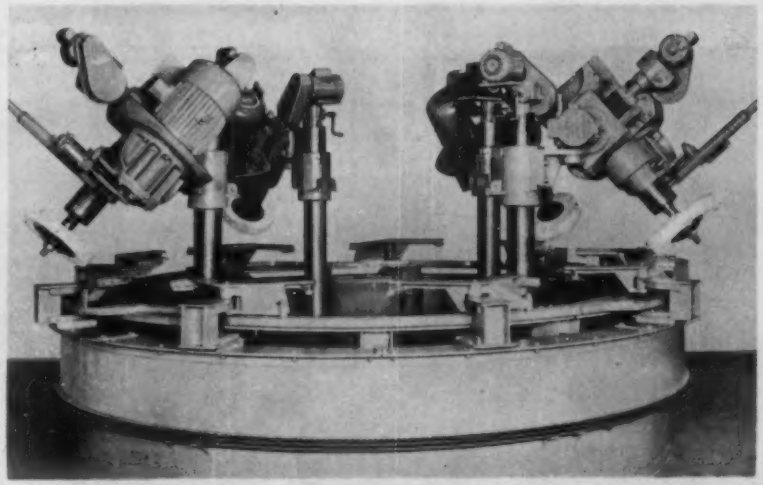
HORIZONTAL HYDRAULIC EXTRUSION PRESS, rated at 600 tons, has work area completely shielded in an inert atmosphere. Designed to meet special problems encountered in extrusion of nuclear materials, the press is installed at Argonne National Laboratory, Lemont, Ill—*Sutton Engineering Co, First National Bank Bldg, Pittsburgh 22, Pa* MORE DATA? Circle 67, inside back cover

aluminum gearbox frame assembly. Operation is achieved by use of interchangeable plates carrying multiple spindles.

Workpiece is finish bored in two setups. Five larger holes on one side of the part are bored at the first operation. Locating from established dowel holes and hand clamping the part in a simple fixture, tolerances on hole diameters are held to within 0.0005 in. Second operation involves boring from both sides. Here the original spindle plate is detached and interchanged with a seven spindle plate. A ten spindle component is mounted at the other end of the machine. After one lot is rapidly bored by this method, bronze bushings are assembled in the holes in the workpieces, tools are changed at the machine and the operation is repeated. These parts were formerly bored in a toolroom setup requiring a full day to complete one part; now they are finished in a matter of minutes.

Ex-Cell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich

MORE DATA? Circle 68, inside back cover



AUTOMATIC POLISHING AND BUFFING MACHINE that features a rotary conveyor design which cuts floor space requirements finishes angular-shaped automotive trim at rate of 350 pieces per hr. The 12-ft dia machine consists of a rotating outer conveyor ring, which holds an 8-in. wide table, and a stationary inner ring. Work pieces, riding on the table, move past buffing wheels mounted on adjustable lathes spaced around inside of conveyor—*Acme Mfg Co, 1400 E Nine Mile Rd, Detroit 20, Mich*

MORE DATA? Circle 69, inside back cover

Niagara Line of Air Presses Offers from ½-2 Ton Capacities

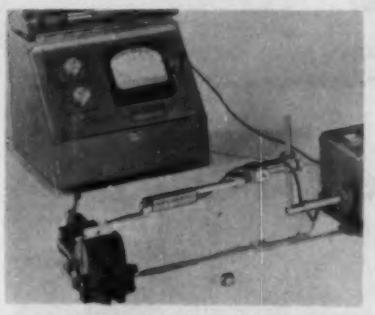
Completely new line of precision-built, single-acting air presses features four press sizes ranging from ½-2 ton capacities at 85 psi. Twenty-eight models are available for punching, swaging, staking, upsetting, and imprinting operations plus seating and removal of close tolerance bearings and bushings.

Line includes a choice of 3 air and 3 electrical control systems. For specialized applications, electronic timers, speed control valves, and pressure limit controls are available.

Stroke lengths and shut heights are infinitely adjustable within range of each press size. A diaphragm-type, frictionless air cylinder which requires no lubrication provides continuous production and maintenance-free service. All models may be bench mounted or furnished with floor stand.

Niagara Machine & Tool Works, 683 Northland Ave, Buffalo 11, NY

MORE DATA? Circle 70, inside back cover



Surfindicator Adapter Measures Sharpness of Tool Cutting Edges

New adapter for the Surfindicator (unit for measuring surface finish) has a chisel point which permits surface measurements of cutting edges, knife edges, and components with very small OD's such as coil winding wire. Designated Model BL-130, it is an accessory to the General Purpose Pickup of the Brush Surfindicator BL-110. Adapter is designed for use with Brush Motor Drive BL-117. With the unit inserted in the Pickup, radii from 0 to ½ in. can be measured for surface roughness in the range from 0 to 1000 micro-in.

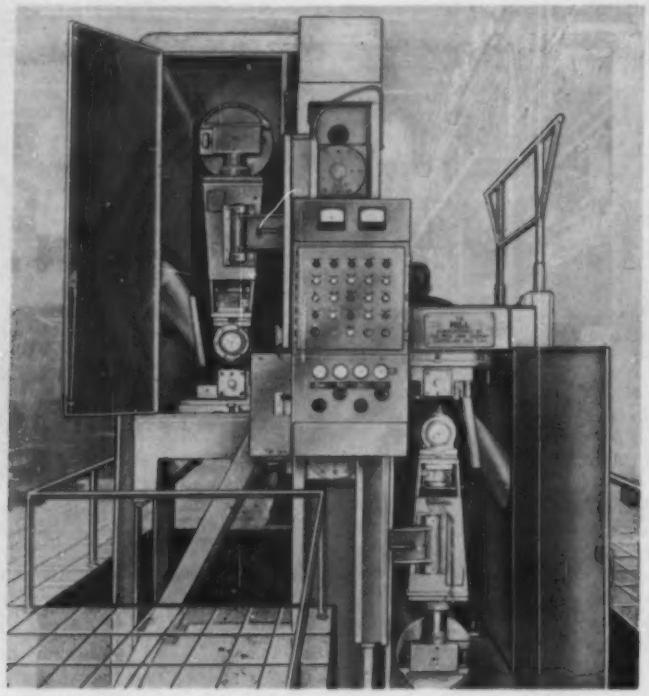
The BL-130 has a sapphire stylus with chisel point 1/16 in. wide and a radius of 0.0005 in. It will read the arithmetical average of the displacement of the chisel-shaped sapphire. Maximum force exerted by the stylus is 2 g. Radius of skid is 0.12 in. Overall dimensions are 2¾ x ⅝ x ⅞ in.

Brush Instruments, Div of Clevite Corp, 37th & Perkins, Cleveland 14, Ohio

MORE DATA? Circle 71, inside back cover

PRESS MOUNTED EXTRACTOR is self-contained and requires only one electrical connection with press. Press hand is equipped with manual inching controls mounted to side of press and an adjustable vertical lift cylinder—*Die & Automation, Inc, 5353 Dixie Hw'y, Hamilton, Ohio*

MORE DATA? Circle 72, inside back cover



Hill Acme Double Side Strip Grinder Processes Stainless Strip 54-in. Wide

Machine, said to be the world's largest over-and-under type, simultaneously grinds both sides of stainless strips up to 54-in. wide, thereby eliminating need for turning the coiled strip as in usual grinding operations.

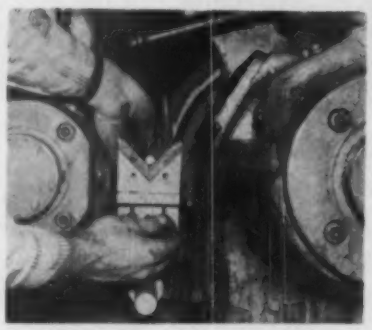
Two standard Hill two-roll vertical abrasive belt grinding heads — one mounted normally and one in an inverted position—turn a 56-in. abrasive belt. They are powered by two 125 hp motors. The pass line of the stainless strip is reduced, because three feet of the machine is placed below floor level. Total overall machine height is approximately 13 ft.

Because the adjustable grinding heads are hydraulically operated, the machine will grind different thicknesses of material at varying pressures of belt during grinding operation. Machine is complete with all motors, hydraulic pumping unit, and pushbuttons with relays for main starters, but the main across-the-line starters must be provided by user and placed in a central control panel. Automatic tension on the abrasive belt with continuous take-up for stretch is provided.

Manufacturer recommends the grinder for removing imperfections prior to cold rolling operations and for final finishing of coiled strip. They can modify it to operate as a "feed roll" type machine which processes cut strips with a minimum length of 5 ft.

Hill Acme Co, 1202 W 65th St, Cleveland 2, Ohio

MORE DATA? Circle 80, inside back cover



Adjustable-V Workpiece Supports Fit All Centerless Grinders

Tru-Grind workpiece support, attached on "in" and "out" sides of centerless grinders, eliminates all taper to very end of workpiece in thru-feed and spot, or plunge grinding of all materials and lengths. Device allows one man to do the work of two, has accuracy of 0.00005 in.

The installation, which consists of two complete Adjustable-V outboard supports, brackets, and soft jaws (to prevent scratching on output side of grinder) is available to fit all centerless grinders.

Livingston Tool & Development Co, P O Box 549, Belmont, Cal

MORE DATA? Circle 81, inside back cover

Motor-Driven Spring Tester Has Capacity From ¼ to 550 lb

Tester uses a heavy pendulum hung on knife edges permitting high precision checking of large compression and extension springs. Unit handles spring lengths up to 20 in., diameters up to 5 in.; speed is up to 600 tests per hour.

Optical system magnifies the load and projects it onto an illuminated glass plate containing tolerance markers. Weight changing is not required and the tester may also be used for compressing springs solid to remove permanent set. Adjustable stops permit testing of loads at 1, 2, or 3 different lengths in the same setup.

Carlson Co, 3457 Weidner Ave, Oceanside, LI, NY

MORE DATA? Circle 82, inside back cover

Jacobs Collet Chuck Uses Rubber-Flex Collets

Model 50 has a handwheel-operated, nose-type closure and Rubber-Flex collets. According to manufacturer, it offers user complete collet chucking at a cost of $135.00 for chuck and set of ten collets.

The chuck has 0.001 in. tir accuracy at nose of chuck, a range of 0.100 in., bar capacity from 0.100 to 1.063 in., and direct spindle mounting without need for threading adapter. It can be used to chuck tubing and fragile materials, and to hold round pieces on drill press tables, milling machine tables, and magnetic chucks.

Jacobs Mfg Co, West Hartford, Conn

MORE DATA? Circle 83, inside back cover

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CREATING THE METALS THAT SHAPE THE FUTURE

New cutting tool materials... through metallurgical research

Years of research, experimentation and comprehensive testing have been devoted to every type of product being manufactured at V-R. By working closely with all types of industry, this metallurgical knowledge is effectively applied to meet industry's ever-changing demands for new cutting tool materials.
Above is a V-R metallurgist checking specific gravity of a metal sample on an ultrasensitive scale. Research, such as this, provides the basis for developing new cutting tool materials; for example, VR-65, a new titanium cemented carbide grade, for ultra high speed machining on *all* types of steel.

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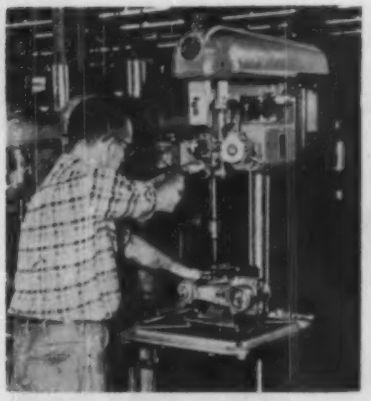


Delta Introduces Line of 20-in. Drillpresses With Power Feed

Line of 20-in. power feed drill presses are available in 18 models including bench, floor, multiple-spindle and overhead track-mounted.

The mechanical power feed has a front-mounted pilot wheel control mechanically integrated with the clutch control to allow one-hand operation. There are four feed ratios, 0.004, 0.006, 0.009 and 0.012 ipr, for each of the five spindle speeds.

By a simple torque adjustment, the operator can switch from a machine that handles drills in the 1/16-in. range to a machine delivering 1000-lbs of thrust for drilling holes up to 1-in. in cast iron. Spindle travel is 6 in. Price for single-spindle floor model is $584.

Rockwell Mfg Co, Delta Power Tool Div, 470 N Lexington Ave, Pittsburgh 8, Pa

MORE DATA? Circle 84, inside back cover

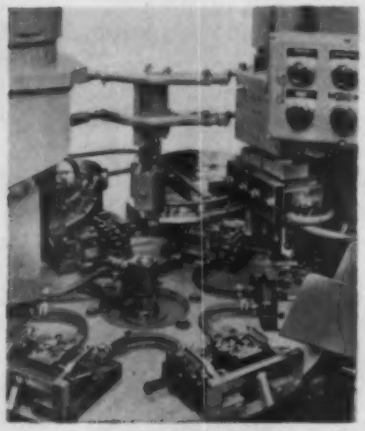
Four Film Adhesives from 3M Good for Honeycomb Assemblies

Four new dry-bonding adhesives, designated Scotch-Weld AF-10, AF-30, AF-31, and AF-32, were produced for structural bonding and honeycomb sandwich construction. The elastometer-phenolic film on these adhesives, which provide uniform thickness throughout a joint, is easy to apply and confine to bonding area. Because film adhesives do not contain solvents, waste and shrinkage are avoided and solvent hazards and drying problems are eliminated. They are available in varying widths and thicknesses and can be die cut into complicated shapes if desired.

Shear strengths range from 3040 to 4180 psi with peel strengths ranging from 55 to 110 lbs per in. width at 75F. Maximum strength is obtained with an optimum cure of 1 hr at 350F under 100 psi. However, high bond strength in excess of 2500 psi tensile shear strength can be obtained with cure time as low as 2-3 min at temperature in the 400-450F range.

Minnesota Mining and Manufacturing Co, 900 Bush Ave, St Paul 6, Minn

MORE DATA? Circle 85, inside back cover



Dual Head Dial Feed Bench Welder Aids Electrical Parts Assembly

Closeup shows six-station Geneva dial feed table of AVB-3 line tooled for welding spring contacts to two different style yokes for electrical outlets, one of which requires a forming operation (forming head is at left). Machine has three vibratory hopper feed units and an automatic ejector mechanism.

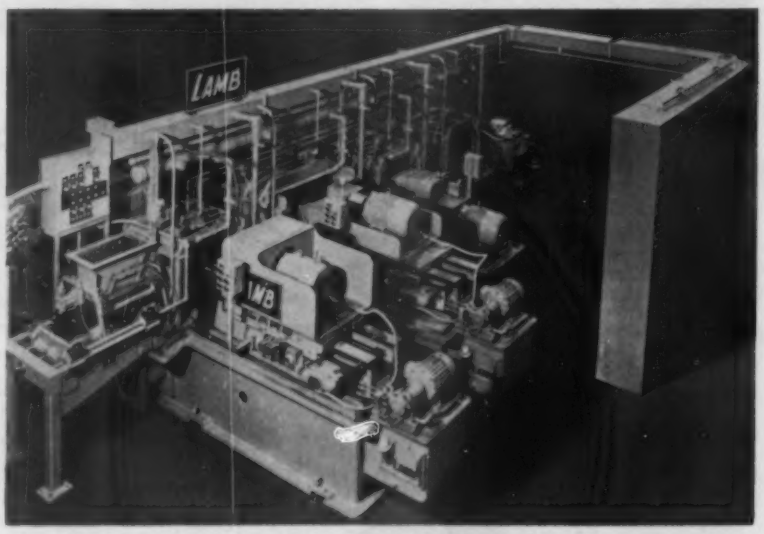
The springs in operation pictured are series welded to the yokes by dual, adjustable, air-operated welding heads, mechanically interlocked and balanced. Production rate is 1500-1700 parts per hour. Models are available with 10-50 KVA transformers.

Precision Welder and Flexopress Corp., Cincinnati, Ohio

MORE DATA? Circle 86, inside back cover

SURFACE GRINDER, Model 612, is a low-cost, precision machine featuring automatic forced lubrication, direct drive motor, and choice of right or left hand longitudinal feeds as standard equipment. These features are said to be found only on expensive models — *Harig Mfg. Corp., 5757 Howard St., Chicago 48, Ill.*

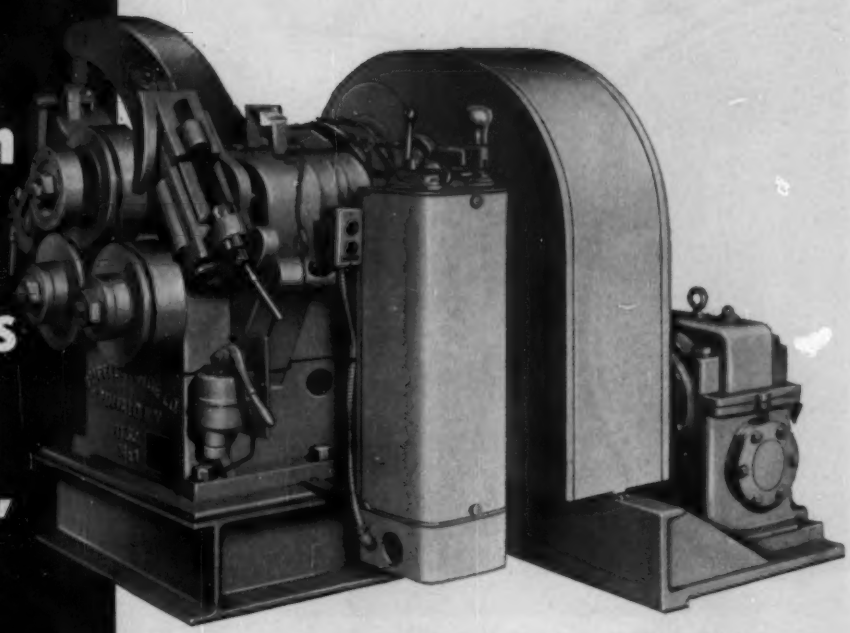
MORE DATA? Circle 87, inside back cover



HOPPER-FED 6-STATION TRANSFER MACHINE core drills, slot mills, and taps both ends of 625 steering tie-rod sleeves per hr. The parts, 4 per station, are carried in U-type brackets mounted to roller chain conveyor. Features include: all standard building block components, automatic lubrication, oil mist to heads and chain conveyor, electrical interlocks, JIC hydraulic and electric standards— *F Jos Lamb Co, Detroit, Mich*

MORE DATA? Circle 88, inside back cover

Put Your Production Bending Operations "IN THE BLACK"



with BUFFALO BENDING ROLLS

These fast, accurate, dependable machines quickly bend circles, segments and spirals. They handle angles, rounds, squares, tubes, beams, channels, flats and special shapes. Easy roll changes eliminate need for expensive dies. Hydraulic top roll adjustment saves setup time.

Like all Buffalo products, Bending Rolls are quality engineered and built throughout. Unique speed reducer eliminates gearing, delivers more power in compact space.

Exclusive Buffalo "Leg-In" Attachment simplifies bending of angles leg-in. Saves time because work will not twist or get out of square. Acts as a gauge when rolling a run of circles to same diameter.

The complete line of Buffalo Bending Rolls includes models and sizes to handle all types of work. The model you need could be saving you production and maintenance dollars **right now!** For full details call your Buffalo machine tool dealer, or mail coupon today.

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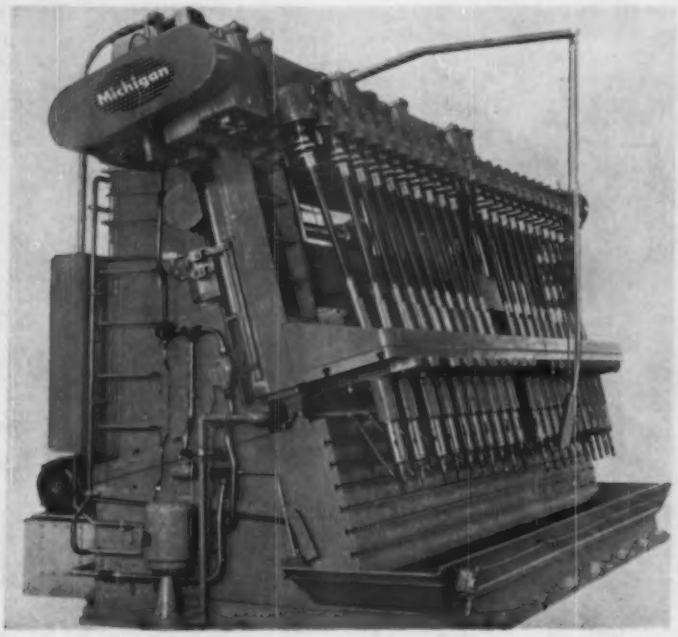
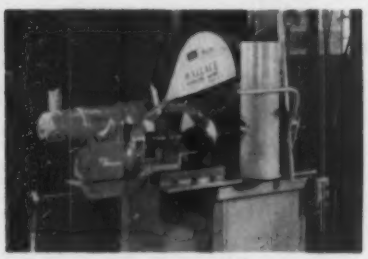


MULTIPLE-SPINDLE HYDRAULIC DRILLING MACHINE, with 24 upper, individual drives, drills railway rails and rail frogs, with any desired hole patterns, to adjustable depths. The 16-ft T-slotted face plate is set on a 15° angle back of vertical. Each of the 24 spindle assemblies is adjustable from 9-13 in. from face plate, and has maximum capacity of 1½ in. in steel—*Michigan Special Machine Co, 11449 Timken Ave, Warren, Mich*

MORE DATA? Circle 89, inside back cover



Modular Cutting Unit Speeds Riser Removal From Castings

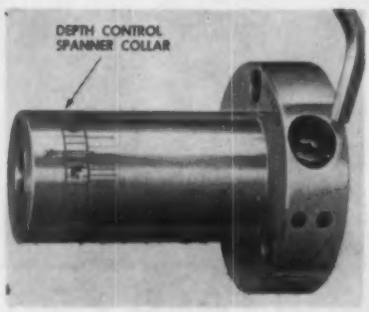
Roto-Trimmer for fast, accurate cutting of risers from foundry castings is equipped with a chuck that rotates, in addition to the abrasive cutting wheel. This lessens the arc of contact and keeps the work cooler as it cuts.

Chuck capacity is 9-in. OD x ½-in. wall stainless steel rings or 6-in. solids, cutting off the risers with 0.031-in. maximum corner radii of the cutoff surface. Chuck jaws are adjustable for ID or OD grip. Chuck is laterally adjustable for 0 to 6-in. clearance from the index position (under cutting wheel) so other material not necessary to be chucked may be cut. Separate starting switches for the rotator chuck and cutting spindle drives are provided.

Dimensions are 60 11/16-in. width, 55-in. depth, 65⅜-in. height. Price is $3495.

Wallace Supplies Mfg Co, 1304 Diversey Pkwy, Chicago 14, Ill

MORE DATA? Circle 90, inside back cover



Precision Boring Quills Permit Infinite Size Control

Boring quills that allow infinite adjustments in controlling the size of holes without loosening or tightening screws also permit incorporating an integrally operated depth-control adjustment when required. User can split tenths (adjust smaller than 1/10,000 in.) to compensate for tool wear on ultra-fine tolerance boring jobs simply by adjusting with a hex-key. Formerly, Briney boring quills only allowed adjustments by turning the calibrated bearing bushing with a spanner wrench.

New design eliminates need of two bearings within the unit, permitting smaller bodies. Adjustment is accomplished by a small worm-gear drive located within the quill's mounting flange. This drive is engaged with the boring bar or bar holder and a hex-key is used to adjust the tool. A positive drive to the boring bar is provided by the worm-gear hook-up. These new quills are available to fit all standard boring spindles. Prices start at approximately $275.

Briney Mfg Co, 1165 Seba Rd, Pontiac, Mich

MORE DATA? Circle 91, inside back cover

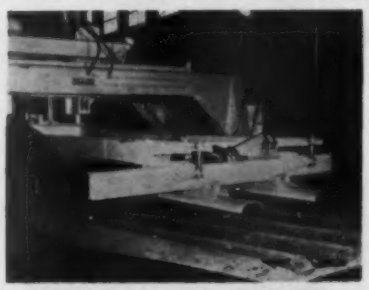
New Aluminum Chain Hoist Features Improved Load Brake

Reading Hoist, available in seven sizes, ranging from ½ to 10-ton capacities, incorporates a noiseless load brake that is said to offer maintenance-free operation and added safety. Easy operating features include a light hand chain pull and load chain guide that surrounds the load wheel so that the chain cannot bind, regardless of pulling angle.

Use of aluminum wherever possible has enabled the manufacturer to produce a ½-ton capacity hoist that weighs only 26½ lb, including 10 ft of chain, and a 3-ton capacity unit weighing only 70½ lb. One man can lift and hang up either of these hoists.

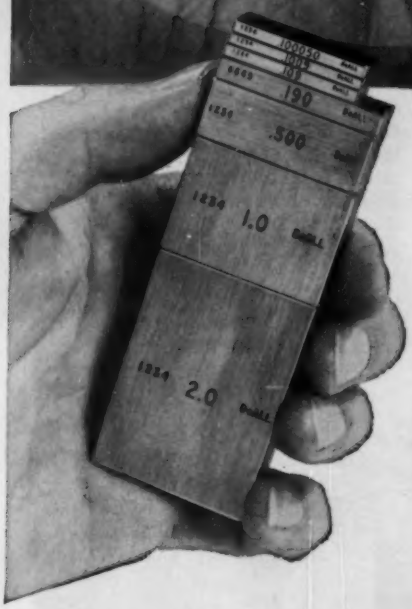
Reading Crane & Hoist Corp, 2100 Adams St, Reading, Pa.

MORE DATA? Circle 92, inside back cover



GANTRY VACUUM UNIT with long cantilever arm feeds an 1800-ton narrow throat forming press with either flat or corrugated steel plate used in assembly of railroad gondola car ends. Specially designed pads fit the corrugated plate; standard pads are used on flat stock—*Vac-U-Lift Co, Div of Siegler Corp, Salem, Ill*

MORE DATA? Circle 93, inside back cover



The clearly etched size designations on the new DoALL gage blocks make it easy to check the combination *after wringing*. The figures form a column that's quickly added when verification is necessary.

2 IMPORTANT IMPROVEMENTS

to save time and increase service life of standard steel or stainless steel

DoALL GAGE BLOCKS

Just out! A brand-new self-indexing pocket case that saves time in finding and removing the *correct* gage block—without touching other blocks or gaging surfaces. And a new and better way of showing size designations on the individual gage blocks.

DoALL's new index case is designed to show the size marking on the block itself and its correct slot in the case at all times—even when the case is completely filled. It's faster and easier to use.

The new method of etching size designations on the side, or non-gaging surface, lets the user see the size of each block at all times—even *after the blocks have been wrung* together. No more disassembling to double-check the combination. And the size markings line up to form a column that's easily checked against your list of required blocks.

DoALL gage blocks have long been quality leaders in accuracy, hardness, long life and now, the only blocks available in ultra-stable stainless steel. These important improvements are unmatched—anywhere. Call your local DoALL store and ask the gage specialist for complete information!

During the Machine Tool Exposition, see DoALL's Demonstrations at the Coliseum, Navy Pier, Hall of Progress.

C8-38

This is a typical DoALL Store

The DoALL Company, Des Plaines, Illinois

Electronic Mist Precipitator Removes Pollution From Shop Air

Misti-Maze is a self-contained unit that removes oil mist, smoke, and fumes from air exhausted from industrial operations such as machine tools and welding booths. Compact model contains a blower, filter, and an electrostatic precipitator. Collected coolant from machine tool operations can be returned to the machines for re-use; air exhausted from the Misti-Maze is recirculated to the shop, reducing heating and air conditioning costs.

Unit requires only a simple ductwork to the machine tool or welding booth to collect polluted air; only other installation requirements are an electric power connection and drain. It is available in two sizes, one rated at 600 cfm capacity and the other at 1200 cfm.

Air-Maze Corp, 25000 Miles Rd, Cleveland 28, Ohio

MORE DATA? Circle 94, inside back cover

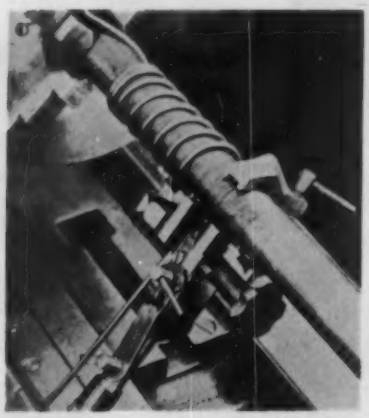
New Machinery Mount Maintains Absolute Level

Serva-Levl Mount for precision applications maintains level within 0.0005 in. per ft of length, regardless of load, with repeatable accuracy better than one-tenth of 1%.

Basically a pneumatic servomechanism, it is installed by sliding it under the support points of the equipment. Leveling is easily and quickly accomplished by Allen wrench adjustment. Operating from standard factory air supply, the mount automatically compensates for changes in loading, variations in floor level due to changes in foundation rigidity, external and internal thermal changes. At the same time that it makes this automatic compensation, the mount effectively isolates vibration and shock, since the mounted equipment is supported on a cushion of air. This device is first of a series of new mounts.

Barry Controls, 700 Pleasant St, Watertown, Mass

MORE DATA? Circle 95, inside back cover



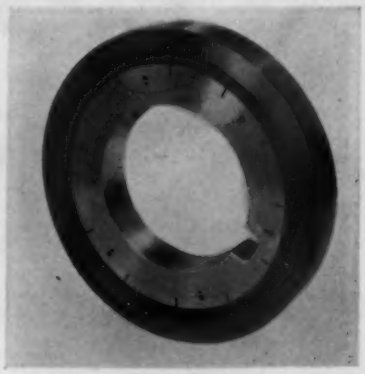
Spring Winding Attachment Covers Wire Sizes up to 0.600 in.

Helios Springwinder is designed for producing precision coil springs from round and square wire. It can be used manually in a vise for smaller wire sizes. Tool attaches to any lathe with minimum setup time; once set it will duplicate any number of springs with the same close tolerances.

Built-in pitch control eliminates use of leadscrew. Cylindircal extension springs with variabel initial tension as well as compression springs with any desired pitch and closed ends can be produced with this equipment. Three models are available: No. 1 covers wire sizes from 0.008 to 0.060 in.; No. 2, 0.020 to 0.200 in.; No. 3, 0.080 to 0.600 in.

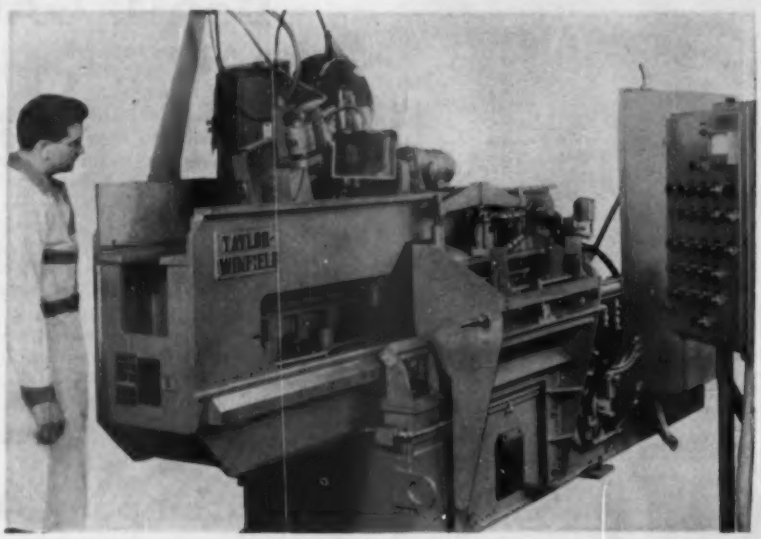
Collins-Faust Co, 18 Park End Pl, Forest Hills 75, NY

MORE DATA? Circle 96, inside back cover



ROTARY SLITTING and side trimming knives, with a tungsten carbide outer rim and alloy steel body, are reported to hold their cutting edges 10-15 times longer than steel knives, when used for side trimming or slitting light gage ferrous or nonferrous materials—*Cowles Tool Co, 2086 W 110th St, Cleveland 2, Ohio*

MORE DATA? Circle 97, inside back cover



AUTOMATIC ARC WELDER joins galvanized strip for continuous feed into helical pipe forming machine. A tungsten electrode and argon gas butt welds strip coils, which are matched properly because of a built-in shear. Silicon steel, copper, brass, nickel, and aluminum alloys can be welded rapidly with only variations in welding techniques—*Taylor Winfield Corp, 1048 Mahoning Ave, Warren, Ohio*

MORE DATA? Circle 98, inside back cover

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CIRCLE C (T-5) (ground)
High Temperature Cutting

high cobalt-tungsten super high speed steel of well-balanced composition with superior *red hardness* and *wear resistance.*

VAN CHIP (M-3) (unground, ground)
General Purpose Cutting

high carbon, high vanadium moly-tungsten high speed steel with exceptional *wear resistance* and *red hardness.*

CIRCLE T-15 (T-15) (ground)
High Abrasive Cutting

tungsten base, high carbon, high vanadium cobalt high speed steel with superior *abrasive resistance* and *red hardness.*

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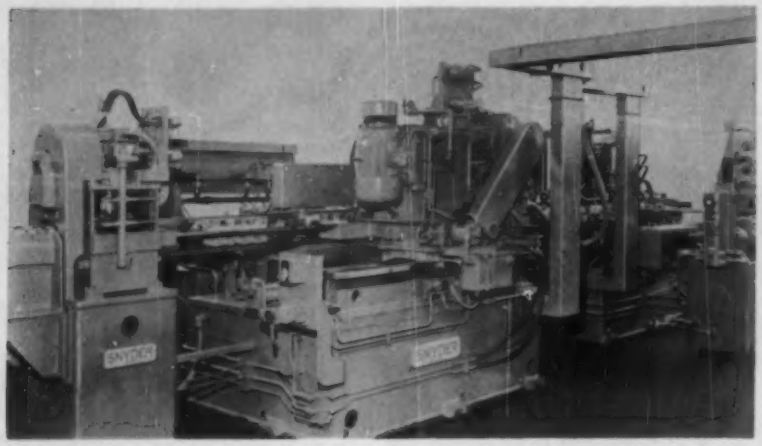


SPECIAL EIGHT-STATION TRANSFER MACHINE rough mills cover face, exhaust bosses, construction bosses, joint face and intake face on aluminum automotive engine intake manifolds at a rate of 120 pieces per hour. The electrically controlled, hydraulically operated machine has two hydraulic power packs and an automatic lubrication system—*Snyder Corp, 3400 E LaFayette, Detroit 7, Mich*

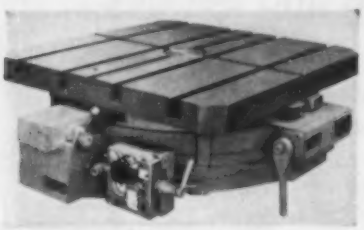
MORE DATA? Circle 99, inside back cover

Vacuum Lifter Speeds Punchpress Parts Handling

Vacuum lifter for feeding and removing work lifts and holds parts securely, releasing instantly with a light touch of the thumb lever. It can also be used for transferring sheets and parts from piles or stacks. In addition to permitting the operator to work without placing hands under the ram, it keeps soil and perspiration from marking finely finished surfaces of all non-porous materials. Length of handle is 15 in. Cup diameters are 1½, 2½, and 4 in.

Safety Vacuum Lifter Co, 321 Elm St, Trenton 10, NJ

MORE DATA? Circle 100, inside back cover



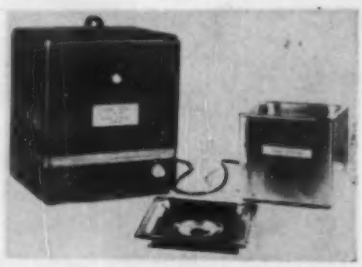
New Airmist Rotary Tables Index Off-Center Loads

Tables index extra-heavy loads even when placed off-center. When they are indexed an air-oil mist lifts the top through specially designed valves in the way surface of the base, floating the top on about 0.001 in. of mist. Lift is automatically distributed so an offset load is always supported. The air-oil mist cannot spill out of the relatively unloaded side of the table. In addition, the air-oil mist prevents corrosion from moisture in the lifting air.

Airmist tables are available in a range of standard sizes starting at 36 in. round or square; special sizes may be ordered. They can be used with horizontal boring mills and milling planers. Units are also furnished on runways for use with floor-type horizontal boring mills.

Cincinnati Gilbert Machine Tool Co, 3366 Beekman St, Cincinnati 23, Ohio

MORE DATA? Circle 101, inside back cover



Small Ultrasonic Cleaner Added to Poly-Sonic Line

Model V-100 is a smaller model in the series introduced last year (*AM*—Sept 7 '59 p164). Like the larger VT-700 it uses several ultrasonic frequencies simultaneously. Completely uniform cleaning results are said to be obtained throughout the volume of the container, even in a parts basket, and more effective cleaning results through use of heated solutions (up to 125 C). Units operate at 400 kc with overtones down to 20 kc. Size of cleaning tanks range from 5½ x 4¾ x 2¼ in. deep, or 1¼ qt, to 5 x 9 x 2¼ in. deep, or 3½ qt. Price is $490 fob.

McKenna Laboratories, 2503 Main St, Santa Monica, Calif

MORE DATA? Circle 102, inside back cover

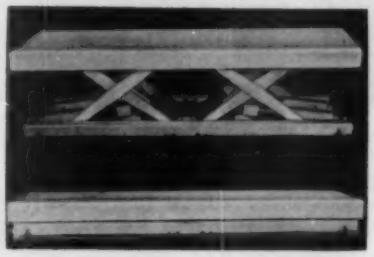
Adjustable Speed Drives Offered With Ratings From 1/40 to 3 hp

Newly developed ECI-Drives, easily controlled and programmed, are reported to insure 1 to 2% regulation without tachometer feedback to automatic-drive machine tools and special purpose machinery.

Drives feature a highly sensitive static feedback control which can be automatically reset to follow an unlimited number of input signals to change speed or mode of operation. Speed changes, acceleration, deceleration, precision slow-down, precision shaft rotation stop, and dynamic braking and reversing are easily sequenced. Drives can be provided to receive control signals manually, mechanically, electrically, or electronically. Inputs originating from punch tape can also be easily accommodated.

Electronic Controls Inc, ECI Mfg Div, 85 Magee Ave, Stamford, Conn

MORE DATA? Circle 103, inside back cover



24,000-lb-Capacity Lift Table Added to Southworth Line

The LT-12, heavy-duty tandem unit employing the same basic hydraulic-powered, scissor-type lifting mechanism as other Southworth models, has the additional advantage of a collapsed height of only 8½ in. Extended height is 40 in. and it is available with platforms in various sizes as well as with tops suitable for turntables, conveyor units, fixtures, or other custom-built working devices. Unit, with its self-contained motor and pump assembly, can be simply positioned by the machine it is to serve and merely plugged in.

Southworth Machine Co, 30 Warren Ave, Portland 2, Me

MORE DATA? Circle 104, inside back cover

In this 1960 LEWYT Vacuum Cleaner, Flexible Tubing does two important jobs: (1) it carries dirt, (2) it conducts electricity

Proof that today's designers can make Flexible Tubing do almost anything

In the new Lewyt Vacuum Cleaner, Model 121, a motorized head revolves brushes that beat out and sweep up the dirt. How to get power to this Motorized Beater Sweeper — without unsightly wiring — posed a problem.

Solution: Flexible Tubing's "Vac-U-Flex" vinyl hose. It carries the dirt — and conducts the current through a unique double-coil wire reinforcement *inside* the hose wall. Neat . . . simple . . . efficient — and styled to match the machine. Perfect example of the design versatility you get with Flexible Tubing!

Whenever the handling of air, liquids or light solids is a design problem, there's a Flexible Tubing product that can do the job! You can choose fabrics, coatings and sizes to fit your specifications.

Flexible Tubing is at work today in diesel engines, electronic computers, farm combines, television transmitters and hundreds of other places. To find out what Flexible Tubing can do for you, just mail the coupon.

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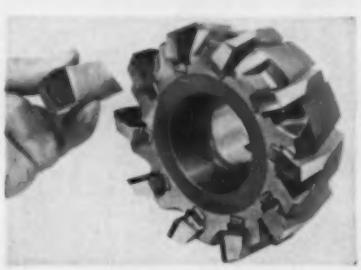
Projected image is measured by means of a glass scale, which gives readings corresponding to 0.00004 in. of object. Prices start from $2200.

Dist by S & S Machinery Co, 140 53rd St, Brooklyn 32, N Y

MORE DATA? Circle 105, inside back cover



Milling Cutter Blade Design Prolongs Carbide Life

Series 7888 automatically increases blade life by an average of 36%; seventeen 0.030-in. regrinds are possible on each blade compared to an average of twelve with blades of the former design. In addition, less carbide is scrapped when the blade can no longer be used. Blades are used in milling cutters for machining cast iron, aluminum, magnesium, and steel.

Available in various Wessonmetal grades, they are offered without an increase in price. They will be supplied on all new Series 5200, 5400, and 5500 milling cutters and can be used without change on existing cutters in these series. Blades are available for either RH or LH cutters having diameters from 4 to 32 in.

Wesson Co, 1220 Woodward Heights Blvd, Ferndale 20, Mich

MORE DATA? Circle 106, inside back cover

New Simplex Toolmaker Microscope Added to Leitz Line

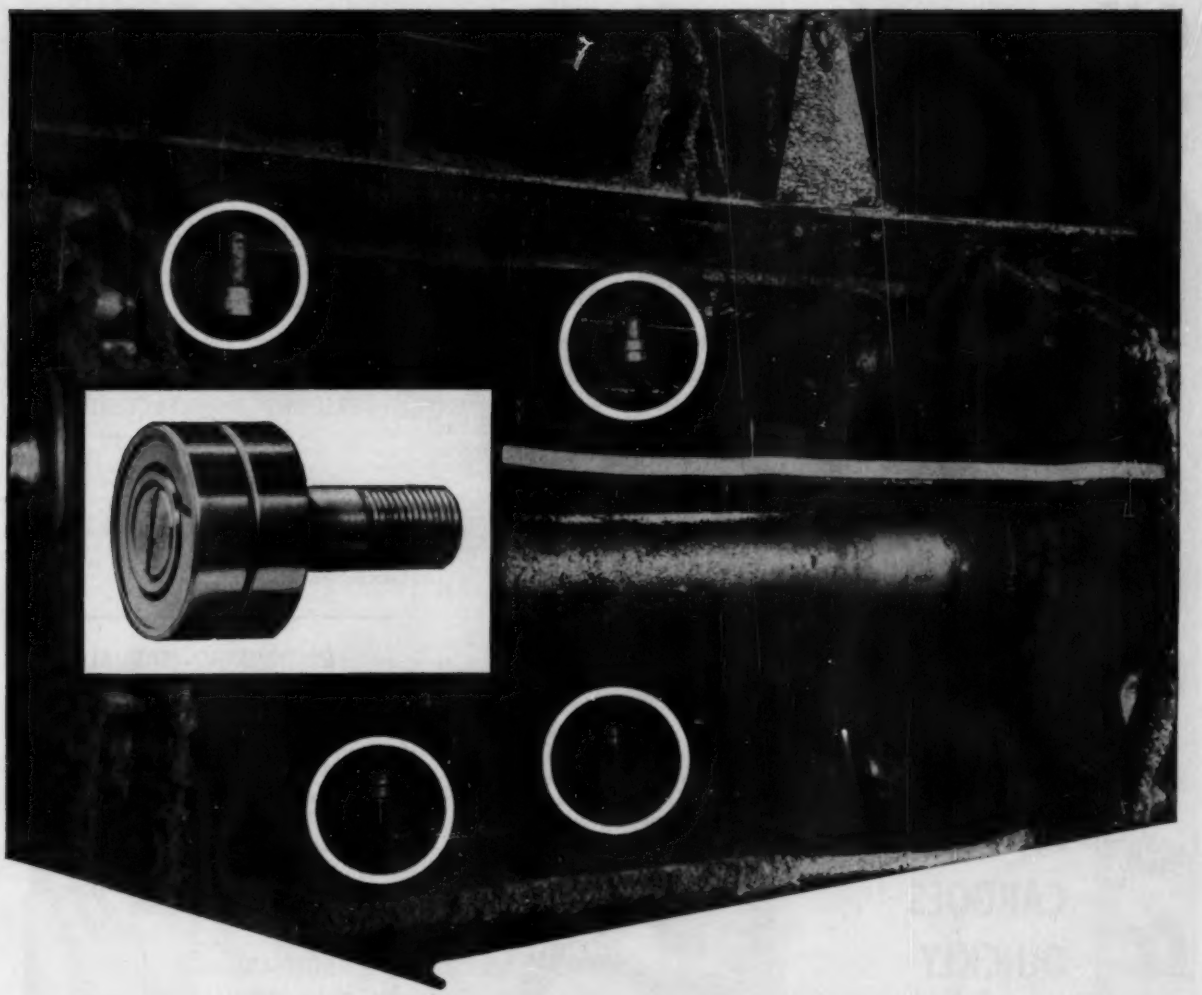
In this new model (line now totals 6 sizes, 11 models) the tilt of the tube to the helix angle has been dispensed with; manufacturer assumes that instrument will be used primarily for coordinate measurements rather than for thread checking. A 360° rotary stage is provided to permit measurements in polar coordinates. Total range is 2 x 2 in. with direct micrometer readings in 0.0001 in. Choice of interchangeable oculars is available.

Opto-Metric Tools Inc, 137 Varick St, New York 13, NY

MORE DATA? Circle 107, inside back cover

ULTRASONIC CLEANER for cleaning large missile parts, nuclear fuel elements and similar items, consists of a 36-40-kc generator and a 75-gallon tank. High frequency output is 3 kw average, 12 kw peak—*Circo Ultrasonic Corp, 51 Terminal Ave, Clark, NJ*

MORE DATA? Circle 108, inside back cover



When thrust loads overpowered original bearings... Bearings, Inc. had the answer!

The original bearings on this automatic machine failed after a short time because they weren't designed to take the thrust loads to which they were subjected. Bearings, Inc. engineers designed and had built a special stud on which were mounted two permanently lubricated and sealed ball bearings.

To keep the cost of this design to a minimum "Locktite", a permanent bonding agent, was used to hold the bearings to the stud. This eliminated shoulders, locknuts or rings yet the bond is as strong as the best press fit.

This installation has now been in operation for many months with no failures reported.

This is not an isolated example of our services — surveys of bearing requirements, inventory control, application engineering, maintenance schedules and procedures are a regular and continuing part of our service to all customers to whom we supply replacement bearings.

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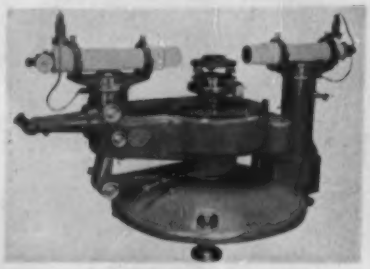
NEW SHOP EQUIPMENT



Microptic Precision Goniometer Reads Direct to 0.1 Sec. of Arc

New microptic precision goniometer for calibration of divided circles, polygons, and angle gages provides direct reading to 0.1 sec of arc. It was developed from the Watts Guild precision spectrometer and adapted with specially improved optics for precise angle testing.

Measurement of the auto-collimator rotation and measurement of table rotation may be obtained separately with equal precision. The table may also be rotated relative to the divided circle about an auxiliary center by means of a micrometer spindle engaging a wormwheel.

Engis Equipment Co, Division of Engineering & Scientific Instrumentation, 431 S. Dearborn St, Chicago 5, Ill

MORE DATA? Circle 109, inside back cover

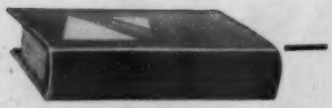
Portable Magnetic Unit Detects Sub-Surface Cracks

Model S-20 Seal-Lock can detect subsurface as well as surface cracks, flaws, and defects in any ferro-magnetic metal. Although priced competitively with ordinary ac yoke units, it reportedly develops the same type of powerful, penetrating dc magnetic filed found in large, expensive intsallations. In tests it has instantly detected defects as deep as ½ in. below the surface of steel bars.

Unit, controlled by one switch, weighs 30 lb and can be operated from a 110-v ac source or from a truck or automobile battery. It includes probe, connectors, sprinkling bulbs, powder, and is contained in a steel carrying case.

US Casting Repair Corp, 6432 Edmund St, Philadelphia 35, Pa

MORE DATA? Circle 110, inside back cover



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Just Published. Explains exactly what infrared radiation is and what it does. Analyzes a typical infrared system and discusses the components of such a system, the laws of physics by which it operates, and the materials involved. Clearly describes the limitations, the problems encountered, and the scope and future possibilities of infra-red radiation. **By Henry L. Hackforth, Northronics, Div. of Northrop Aircraft, 280 pp., illus., $10.00**

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VALVOLINE OIL COMPANY, Petrolia, Pennsylvania
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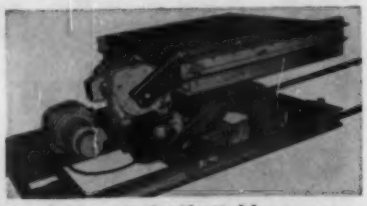


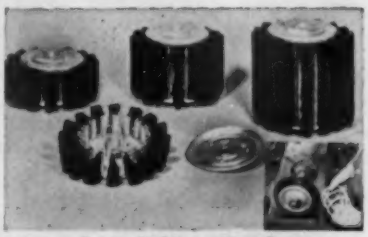
Track-Mounted Lift Tables Designed for Automated Lines

Hydraulic lift tables on transfer cars are designed for moving work from one station to another in automated lines. Weld-Bilt STX scissors-type table (illustrated), mounted to travel on an inverted angle track, is used for either loading or unloading sheets on pallets at the start and completion of a process. There are three 1-hp motors on the table, one each for elevating loads, powering the roller conveyor, and for propelling the car along the track at 25 fpm. The rollers also move loads off and on the table at 25 fpm.

Model shown is in the 4000-lb capacity range. Throwing a lever causes skate wheels to move up between the rollers so that empty pallets can be moved off and on at right angles to the movement of the loaded pallets.

West Bend Equipment Corp, West Bend, Wis

MORE DATA? Circle 111, inside back cover



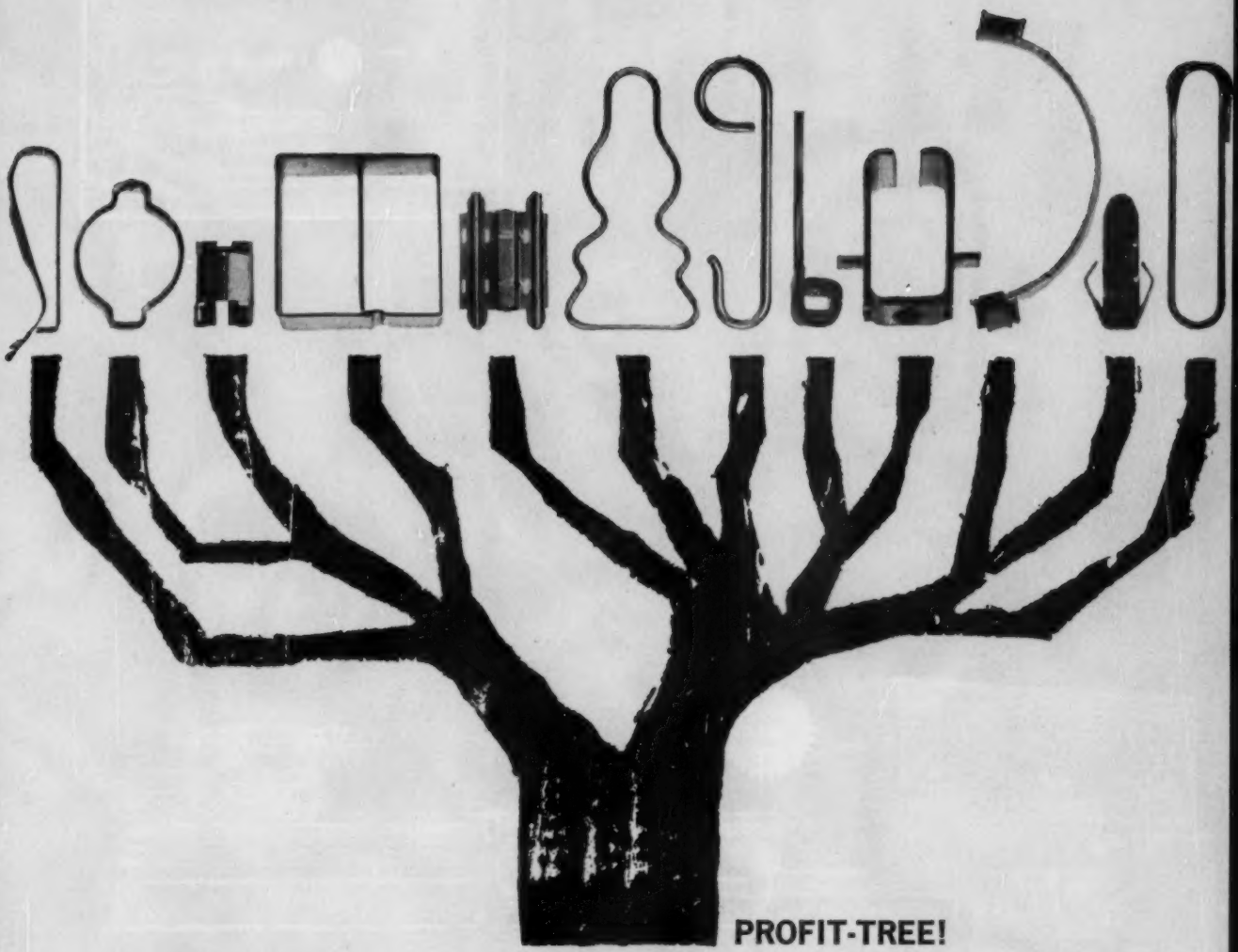
16-Brush Polishing Heads Added to Vonnegut Line

Available in abrasive face widths of 1, 2, 4, and 6 in., these new all-steel 16-brush models match the heavier line of 32-brush heads, providing economy of lesser initial cost with the interchangeability of brushes and brush holders with the 32-brush head. In plants where both heads are in use, only one set of replacement parts need now be stocked. Replacement brushes in both standard (1-1/2-in. trim) and special (long trim 3-1/2 in.) are now available for both size heads as well as brush holders in both cadmium and hard chrome plate.

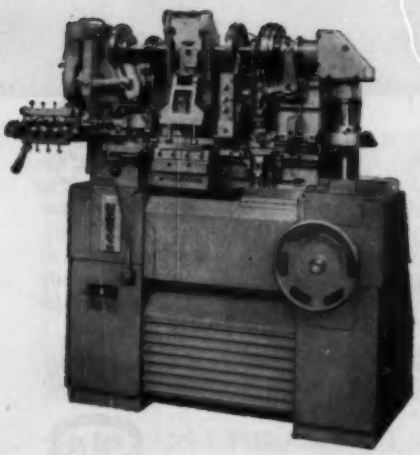
Grinding & Polishing Machinery Corp, 2530 Winthrop Ave, Indianapolis 5, Ind

MORE DATA? Circle 112, inside back cover

THESE PARTS ARE BEING PRODUCED AT SPEEDS OF 90 TO 250 PCS/MIN



PROFIT-TREE!



These are formed parts produced in single automatic operations on the revolutionary new Torrington Vertical 4-Slide.

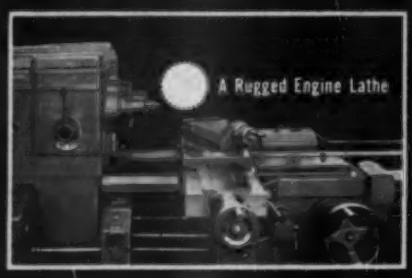
With precision and speed, the Verti-Slide has replaced as many as five and six progressively tooled presses in the production of a complex part. Normal secondary operations such as welding are being done in one continuous automatic operation in excess of 100 pcs/min.

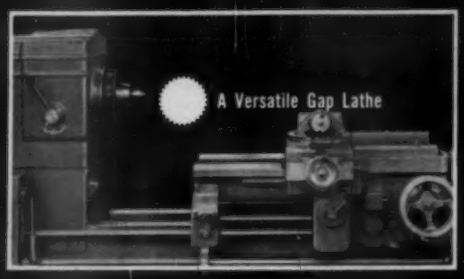
If you make or buy complex wire or strip parts, the Verti-Slide method offers dramatic reductions in production cost. Less parts handling, in process inventory, machine space—all mean greater profits to you.

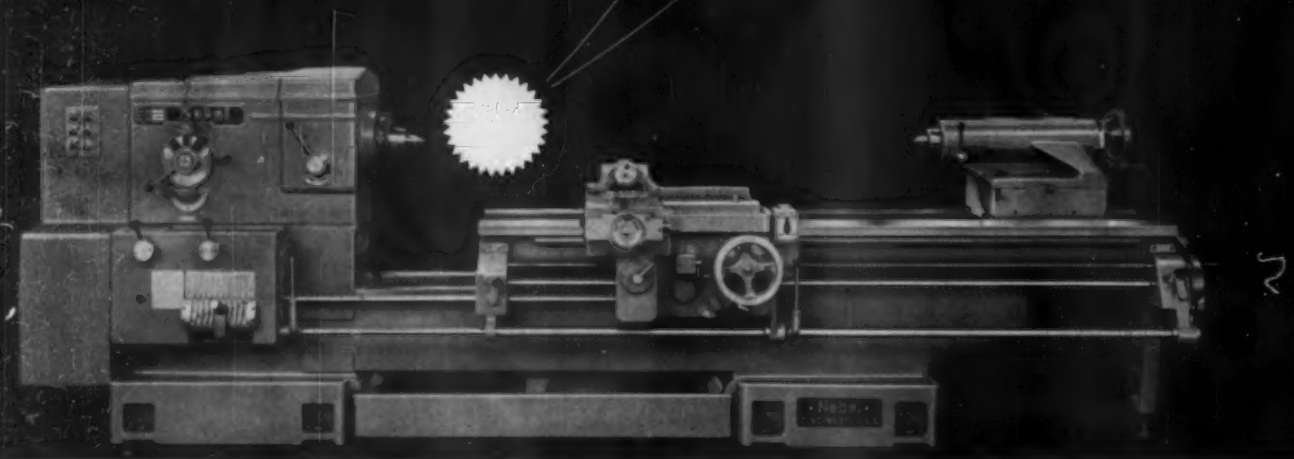
Write or call for field technical data or a Torrington Sales Engineer.

THE TORRINGTON MANUFACTURING COMPANY

MACHINE DIVISION Torrington, Connecticut







NēBEL

HEAVY DUTY
EXTENSION BED GAP LATHE

Now Nebel brings to the heavy duty field the unique benefits of the extension bed gap lathe. The new, proven design, Model HXB 26/45 provides 26½" diameter swing over the upper bed, 46" diameter swing through the gap and 48" to 84" adjustable centers in base length. Built to complete A.S.A. standards for engine lathes it's truly heavy duty in every component part and in turning capacity.

And, significantly, Nebel, with its established economy offers the HXB 26/45 at a price competitive to standard engine lathes. In effect you get 2 heavy duty lathes for the price of one, thereby reducing your capital investment. *Write for new descriptive Bulletin No. 211*

NēBEL LATHE DIVISION, NEBEL MACHINE TOOL CORPORATION
3407 Central Parkway, Cincinnati 25, Ohio . Lathe Builders Since 1899

SEE US AT BOOTH 1319, DONOVAN HALL, AMPHITHEATER, CHICAGO, 1960 MACHINE TOOL EXPOSITION, SEPT. 6—16. MMT-PE

CIRCLE 264 READER SERVICE CARD

FIELD REPORT...

White Motor Co May Purchase Big Slice of Oliver Corp

Oliver Corp is negotiating possible sale of its farm equipment business to White Motor Co of Cleveland. Heads of both companies state that "important progress" has been made in working out a formal contract to be submitted to the boards of each organization and to special meetings of the stockholders. Combined assets of the companies exceed $282.6 million.

Oliver has farm equipment plants in South Bend, Ind; Battle Creek, Mich; Charles City, Iowa; and Shelbyville, Ill. Primarily a farm equipment maker, the firm also produces hydraulic presses and conveyors, among other lines. The 60-year-old White Motor Co, one of the country's oldest and largest independent heavy-duty truck builders, accounts for one-quarter of the nation's output of big trucks distributed through 44 factory branches in the US and Canada and through distributors and dealers in 70 other countries.

Oliver's name has been linked in mergers with other companies. Its negotiations for acquisition by Studebaker-Packard Corp, initiated last November, were terminated in January by mutual consent.

Russell, Burdsall & Ward Enters Plastics Injection Molding Field

Russell, Burdsall & Ward Bolt and Nut Co, Port Chester, NY, and Modern Designers, Hialeah, Fla, have affiliated to form Industrial Plastic Molders Inc to manufacture injection molded plastic parts. R B & W holds controlling interest in the new company which will specialize in volume production of parts with rigid specifications for mechanical applications. Company will also design and make custom molds for injection molding. High-speed automatic molding machines have been installed and manufacturing operation are under way at the Hialeah plant.

Miller under bubble is the brain child of a British machine tool manufacturer who wants to demonstrate to his customers in any weather or location. Milling machine made by Adcock Shipley Ltd, Leicester, England, can be clearly seen, with its demonstrator, through a perspex bubble fitted to a standard English sedan. Provision is made for plugging into local electricity supplies

Mack Truck Plans Big Move

Mack Truck will move its basic manufacturing operations from Plainfield, NJ, to Hagerstown, Md, in October 1961. Company reported last October that it planned to replace the Plainfield facilities with a more modern plant with greater capacity for scheduled expansion. The new multi-million-dollar operation to be put up in Hagerstown will have 1,000,000 sq ft of manufacturing space and will provide employment initially for 2000 workers. Job opportunities will be made available at the new location to many of its present employees if they want to transfer.

Production Machine Co Bought by Wanskuck

Production Machine Co, Greenfield, Mass, producer of centerless grinders and polishing machines, has been purchased by Wanskuck Co, Providence, RI. Company will continue to operate in Greenfield as a division. Wanskuck, formerly a textile manufacturer, ceased these operations about five years ago when New England Butt Co of Providence became a division. Subsequently the company bought Providence Engineering Works Corp and in 1957 acquired the Mossberg Pressed Steel Co of Attleboro, Mass.

National Bureau of Standards . . .

. . . reports that work will begin during the next 12 months on site development and construction of the first three building units for the new Bureau laboratories to be located at Gaithersburg, Md. Congress recently appropriated $23.5 million to finance this initial phase in the relocation of the Bureau. First phase will include construction of an engineering mechanics lab, a radiation physics lab, and the power plant. The two lab buildings were given priority among the 20 to be constructed.

McGIRK'S WORKS

by GEO. CRENSHAW

THAT SWITCHBOARD LOOKS COMPLICATED, HONEY. DON'T YOU EVER GET YOUR WIRES CROSSED?
OH, GOODNESS, NO! I'VE BEEN A SWITCHBOARD OPERATOR FOR YEARS AND I'VE NEVER MADE A MISTAKE YET!
WELL, ALMOST NEVER!
MOE'S CORNER

NEWS FROM WELLS MFG. CORP.
HORIZONTAL BAND SAW PIONEERS

A CONVERTIBLE BAND SAW

that will give you the capacity you've been looking for in a compact, modestly priced machine.

As a horizontal cut-off saw

As an upright saw

The new WELLS MODEL 58-B
Double Duty — Double Value Band Saw

• Here's the all new metal saw you have been asking for . . . Wells Model 58-B . . . designed and built to give you double duty—double value. It's a compact, rugged, well guarded, extremely versatile unit at an economical price.

As a horizontal cut-off saw, Model 58-B features quick action vise (swivels to 45 degrees), automatic shut-off and adjustable guides.

For vertical use, just swing head into upright position and install work table.

To give it complete mobility, a wheel-handle unit is available as optional equipment.

If you cut metal in the shop or on construction jobs, check the profit building advantages of Wells Model 58-B. Call your nearby Wellsaw Dealer or write for descriptive literature.

SPECIFICATIONS

Capacity:			
Rectangular	6" x 10"	Floor Space	19" x 47"
Round	6" Diameter	Height (Frame Vertical)	52"
45° Angle	5" x 5"	Height (Frame Horizontal)	37"
Speeds, f.p.m.	76—141—268	**Vertical Capacity:**	
Blade Size	½" x .025 x 93½"	Work Table	7⅝" x 10"
Motor	½ H.P.	Throat Height	9½"
Width of Bed	8½"	Throat Depth	7¾"
Floor to top of Bed	22¼"	Net Weight (Approx.)	220 lbs.

Wells

The Pioneers of Horizontal
METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
505 ROOSEVELT ROAD, THREE RIVERS, MICHIGAN

Field Report . . .

American Bosch Arma Acquires Joint Ownership of English Firm

American Bosch and DeHavilland Holdings Ltd have acquired joint ownership of S G Brown Ltd, Watford, England, producer of precision navigation and gyroscopic equipment. Company was formerly owned by the British Admiralty and is a major facility in both the British defense industries and the marine industry. Operation of the firm will be under DeHavilland Holdings which is a member company of the Hawker Siddeley Group, a major industrial organization which comprises a broad grouping of companies in the aircraft, missile, and transportation fields. Combined technical and commercial facilities of DeHavilland and American Bosch will be utilized to expand and diversify the product line of S G Brown.

Barry Controls to Merge With Wright Line Inc

Directors of Barry Controls, Watertown, Mass, manufacturer of shock and vibration isolators and suspension systems for aircraft, missiles, and industrial machinery, and Wright Line, Worcester, Mass, producer of accessory and punched card handling equipment for data processing and computer systems, have voted to recommend to their respective stockholders that there be a merger of the two companies. Consolidated firm will be named Barry-Wright Corp. Barry also manufactures instrument drives through its Insco Division and expendable tooling accessories through its subsidiary, Vlier Engineering Corp.

Phelps Manufacturing Acquired by Heli-Coil

Heli-Coil Corp, Danbury, Conn, has acquired the assets of Phelps Manufacturing Co of Westport, Conn. Phelps manufactures a patented line of screw machine bushings used as fasteners by industries fabricating plastics and light metals. Company will be operated as the Phelps Manufacturing Division of Heli-Coil with Guy Phelps Dodge, who had headed the firm, as vice president in charge.

Cincinnati Lathe & Tool Co . . .

. . . associate company of Cincinnati Milling Machinery Co, will manage the latter's Wilmington, Ohio, plant which builds lathes, drilling machines, and Spiropoint sharpeners. James A D Geier, vice president of Cincinnati Lathe, has been named general manager of the plant.

Eaton Mfg Establishes West Coast Office

Eaton Manufacturing Co, Cleveland, has opened a Pacific Coast regional office in San Francisco for the Dynamatic, Cleveland Worm & Gear, and Farval Divisions, which produce parts and components for the consumer, durable, and capital goods industries. Ralph E Bennett has been appointed regional manager.

Electric Autolite to Build Big Plant in Alabama

Electric Autolite Co, Toledo, has bought an 80-acre tract in Decatur on which it'll build a multi-million-dollar production facility for manufacture of light automotive and industrial electrical items. Total investment for land, buildings, and equipment will come to between $6 and $7 million. Company expects to employ between 400 and 500. Facility, which will house 250,000 sq ft of production space is scheduled to be in full operation by spring of 1961.

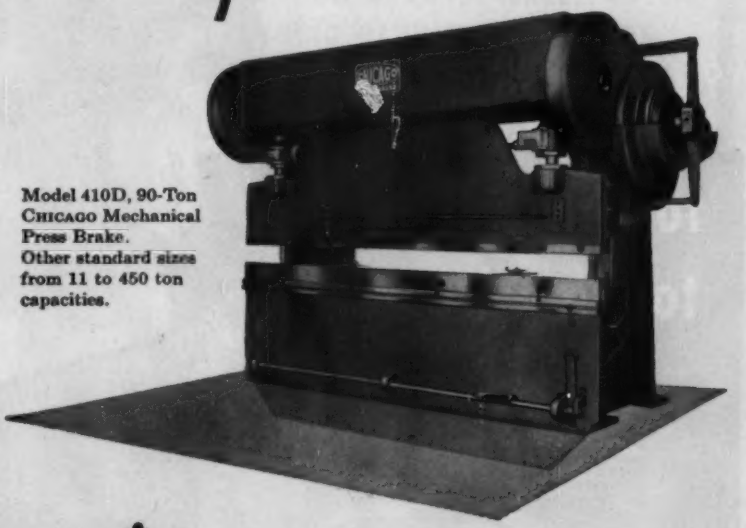
NY Ship Gets Third A-Sub

New York Shipbuilding Corp of Camden, NJ, has a $26 million Navy contract for construction of a nuclear-powered attack submarine, the third to be built by the firm. A $45.3 million order for two other vessels was received last year and construction began on the first one last March. New contract boosts "work ahead" commitments to $236.8 million and will provide employment for 800 workers. NY Ship now employs about 11,400.

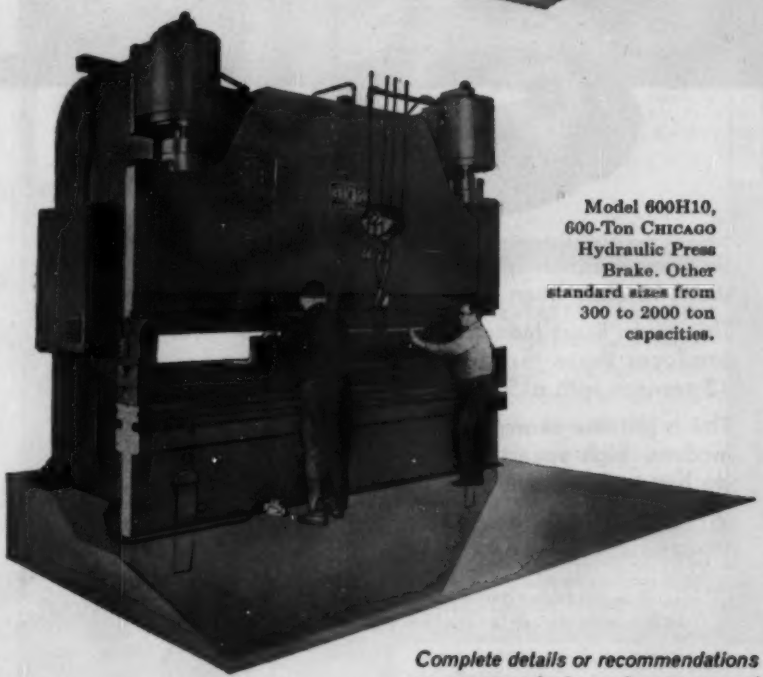
"Not only does he manage to mess up at least one job a day; on top of that his attendance is perfect."

CHICAGO® PRESS BRAKES

unexcelled accuracy / *for sheet metal and plate work*



Model 410D, 90-Ton CHICAGO Mechanical Press Brake. Other standard sizes from 11 to 450 ton capacities.



Model 600H10, 600-Ton CHICAGO Hydraulic Press Brake. Other standard sizes from 300 to 2000 ton capacities.

Complete details or recommendations on any press brake work upon request

8419

Press Brakes
Press Brake Dies
Straight-Side-Type Presses
Hand and Power Bending Brakes
Special Forming Machines

CHICAGO DREIS & KRUMP

DREIS & KRUMP MANUFACTURING CO.
7434 S. Loomis Blvd., Chicago 36, Illinois

It took this HIGH-SPEED Heavy-weight to lick this tough job!

The Lees-Bradner Special High Speed Thread Milling Machine

The Lees-Bradner Special Thread Milling Machine really shows its class when it works with brass!

The Akron Brass Manufacturing Company of Wooster, Ohio produces these threads, internal and external, each in 13 seconds with a 5000 RPM cutter spindle speed.

This is just one example of the many threading jobs that the modern, high speed, Special Thread Milling Machine can do better, faster and with unmatched precision.

Write The Lees-Bradner Company for full information on this remarkably versatile machine.

DETAILS ON THIS JOB

Hob Spindle Speed, 5000 R.P.M.
(Using a high speed cutter spindle)

Thread Pitch
(internal and external) . . . 7½
Thread Diameter . . . . . 3"
Length of Thread . . . . . ¾"
Threading Time . . . . 13 seconds
Material . . . . . Brass
Weight of Parts
Internal thread . . 1 lb. 13 oz.
External thread . . 2 lb. 10 oz.

See the new Lees-Bradner 12-HD and the efficient 7-HD Hobbing Machines at the Machine Tool Exposition BOOTH No. 481

IMPROVING GEARS . . . FOR 50 YEARS!

the LEES-BRADNER Company
CLEVELAND 11, OHIO, U.S.A.

Field Report . . .

Reid-Holcomb Co Opens Yale Industrial Truck Division

Reid-Holcomb, Indianapolis, has formed a new Industrial Truck Division to handle products of Yale Materials Handling Division. Full line of Yale industrial trucks will be handled by the division including gasoline, LP-gas, and electric trucks. Company maintains a service department with major overhaul facilities and separate engine section. Additional facilities are being made available to provide the same service for Yale trucks.

American Metal Acquires Pyron

American Metal Climax Inc has bought Pyron Corp, Niagara Falls, NY, and plans to triple Pyron's production capacity of approximately three and three-quarter thousand tons per year. Scheduled expansion includes construction of a new plant in the Niagara Falls area that'll double the present output and provide for additional growth. Pyron will operate as part of the company's Amco Division which will now be marketing hydrogen reduced iron powder in addition to electrolytic copper powders.

Dodge Manufacturing Forms Swiss Subsidiary

Dodge, of Mishawaka, Ind, has formed a wholly-owned subsidiary, Dodge Manufacturing International, A G, with headquarters in Zug, Switzerland. Swiss company will render technical and management assistance to Dodge licensees abroad. Dodge International has acquired a majority interest in a new operating

"My wife had an accident downtown yesterday! . . . She got her head stuck in a $25 hat."

JARVIS UNVEILS A REVOLUTIONARY DESIGN IN COLD FORMING TAPS!

NEW JAR-FLO

LUBE-GRUV® TAPS

LUBRICATION GROOVES MAKE CHIPLESS FORMING OF INTERNAL THREADS AS EASY AS CONVENTIONAL TAPPING!

NOW, for the first time, cold forming taps that give *full time lubrication* to the *forming contact* area during the *full* tapping cycle.

LUBE-GRUV® gives you a *far superior finish* on the formed threads than is possible with conventional cold forming taps.

USE CONVENTIONAL TAPPING EQUIPMENT. The combination of *positive lubrication* and *narrow contact* surface makes the forming of internal threads much easier than with ordinary cold forming taps. Jar-Flo with LUBE-GRUV has less drag, requires less driving torque.

LUBE-GRUV® Jar-Flo TAPS FOR CHIPLESS FORMING INTERNAL THREADS IN DUCTILE MATERIALS—STRONGER THREADS—NO CHIPS—AVAILABLE IN PLUG OR BOTTOMING TYPES

SEND FOR COMPLETE DETAILS

Jarvis CORPORATION

JARVIS CORPORATION, 104 Washington Park North Attleboro, Mass.

____Have Rep. call ____Rush LUBE-GRUV Brochure

Name _____ Title _____

Company _____

Street _____

City & State _____

Field Report . . .

subsidiary, Dodge de Mexico, S A, with headquarters in Mexico City. Although this company is licensed to manufacture all products in the Mishawaka company's line for distribution throughout Mexico, its first project will be to procure castings and machine tools for the production of V-belt sheaves. Warehouse space will be leased for these and other Dodge products to be imported from Mishawaka.

The Lady Knows Her Diamonds

American Society of Tool & Manufacturing Engineers' Outstanding Achievement Award Pin for the year went to Mrs Margaret J. McGinnis, executive manager of the Industrial Diamond Association in Pompton Plains, NJ. Award was based on her contribution in establishing standards on shank dimensions of diamond tools used for dressing or trueing grinding wheels.

Superior Hone Expands in Tenn

Superior Hone Corp. Elkhart, Ind, has completed construction of a new 15,000 sq-ft plant at Erwin, Tenn, and started operations on the first production line. Main offices, engineering, and development work, and facilities for special runs of honing machines will continue at company headquarters.

Sylvania Research Laboratories . . .

. . . Sylvania Electric Products, Inc, Bayside, NY, is now known as the General Telephone and Electronics Laboratories Inc.

"You'd think the government would come running to us with a missile contract, but no-o-o!"

DRILL DEEPLY into Alcoa Alloy 2017 and take a BIG BITE OUT OF PRODUCTION COSTS! Combines Strength with Low Cost!

Turn out stronger parts—at lower cost and in less time—with Alcoa Alloy 2017-T4 or -T451. Faster cutting than steel . . . with less tool wear and longer machine bearing life. Clean, bright finishes easily machined . . . from stock that weighs ⅓ that of brass or steel . . . into parts that require tough, deep drilling operations.

For exceptionally high strength, turn to Alcoa 2024-T4 or -T351. Cuts at high speeds and gives accurate machining detail for such applications as fittings and threaded fasteners. With 2017-T4 or -T451 and 2024-T4 or -T351, chip breakers are recommended.

You get all these advantages with Alcoa® Aluminum Screw Machine Stock Alloys (which also include 2011-T3 or -T8, 6061-T6 or -T651)—and a complete package of technical data and on-the-spot service is available to you . . . when and where you need it! Ask your Alcoa distributor (or nearest Alcoa sales office) for a free copy of the comprehensive *Alcoa Screw Machine Stock Estimating and Operating Data Book*. Put *all* the data right at your finger tips. Ask, too, for a handy *Alcoa Conversion Calculator*, a slide-rule device that quickly computes costs, shows savings in making a switch from brass to aluminum! Aluminum Company of America, 843-G Alcoa Bldg., Pittsburgh 19, Pa.

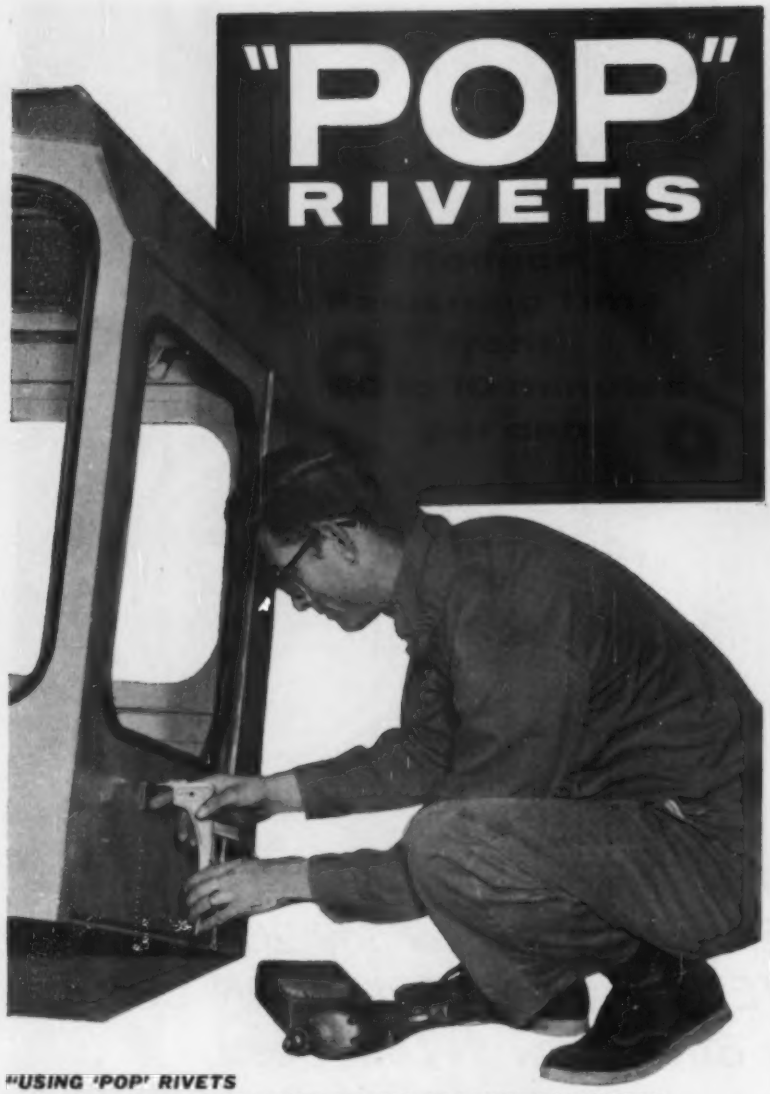
"PLUS" bonuses — when you use Alcoa Aluminum Screw Machine Stock!

1. Wide range of stock sizes.
2. Guaranteed market for up to 60 per cent of your Alcoa Aluminum turnings and borings.
3. Extensive mill and distributor inventories to cover all requirements.
4. Chamfered ends . . . at no extra cost.
5. Specific 12-ft lengths . . . at no extra cost (rounds up to 2¼ in.; hexagons up to 2 in.).

ALCOA ALUMINUM

SCREW MACHINE STOCK

For exciting drama watch "Alcoa Presents" every Tuesday, ABC-TV, and "Alcoa Theatre" alternate Mondays, NBC-TV



"USING 'POP' RIVETS IS LIKE ADDING EXTRA MEN TO OUR PRODUCTION STAFF"

says G. F. Williams, Plant Manager at Industrial Cab Co., Salem, Mass. "And there seems to be no end to the number of jobs which can be done better and quicker with these blind fasteners.

"Because of the wide grip range of "POP" Rivets, problems in joining a variety of material thicknesses have been eliminated. Our fastener inventory has been minimized and instruction time reduced because of the simple installation procedure."

"POP" Rivets are making equivalent savings on boats, metal furniture, appliances, refrigeration and air conditioning equipment, pre-fab houses, truck and trailer bodies and hundreds of other products.

Investigate now the ease with which your company can enjoy the advantages of using "POP" Rivets. Call or write for your personal copy of our new catalog or order the introductory Kit today.

NEW!

LET THIS KIT INTRODUCE YOU TO "POP" RIVETS

The easy way to get started, this introductory Kit contains approximately 240 "POP" Rivets in various lengths and materials together with a hand setting tool. Complete with instructions and application hints. Order today and start saving on fastener costs!

$19.95 postpaid

"POP" RIVET DIVISION
UNITED SHOE MACHINERY CORPORATION
477 RIVER ROAD, SHELTON, CONN.
REgent 5-3391

UNITED
"POP"
RIVETS

Field Report . . .

$7 Million Order to Lycoming

A $7.2 million contract for development and qualification of a higher rated gas turbine engine has been awarded to Lycoming Division of Avco Corp, Stratford, Conn. Order is for a 2200-shaft-hp T55-L-5 engine that'll power the Army's new 3-ton twin-turbine Chinook helicopter now being developed by Vertol. First deliveries will be made in August.

Risdon Adds Plastics Division

Risdon Manufacturing Co, Naugatuck, Conn, has established a Plastics Div at its facilities. The 50-year-old company is a metal fabricator of small components, aerosol, and wire novelties. The division will serve the firm's own needs for plastic components used in conjunction with metal parts and will also produce for other companies.

King Machine Merges With Precision Processing

Two Los Angeles firms, Precision Processing Co, manufacturer of AK and PreCor machine tool attachments, and King Machine & Manufacturing Co, maker of Berkroy sheet metal tools, have merged, combining manufacturing facilities of both companies. New organization will retain the King name.

Chrysler Gives 39 Engines

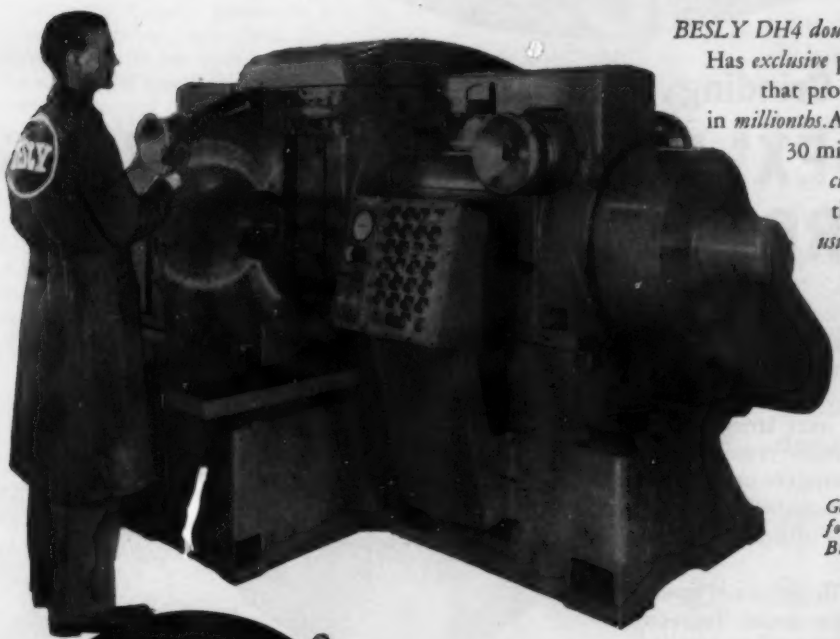
Thirty-nine new Plymouth engines for use in vocational training classes have been donated to high schools and other institutions in Delaware, Maryland, and Pennsylvania by the Chrysler assembly plant at Newark, Del.

"I seem to smell coffee!"

Tool bit squared to ±.001 inch!

Hardened (63 Rockwell, C scale) high-speed steel tool bit, 4" x ½" x ½", was finish ground on four sides in a BESLY DH4 grinder at rate of 600 pieces per hour. Size was held to ±.001", parallelism (square across corners) to .001". Stock removed was .012 per side (.024 per pass). The tool bits distorted by heat treatment, are quickly trued up by the twin discs of the grinder.

If your grinding equipment can't turn out such results...**Better see Besly!**



BESLY DH4 double horizontal spindle disc grinder. Has *exclusive* precision quill and clutch infeed that provides feed increments calibrated in *millionths.* Abrasive discs can be changed in 30 minutes without disturbing setup, *cutting downtime in half.* Dressing time is only four minutes, *⅕ the usual time!* Simplified push-button operation and controls, built-in dials, gages and meters to indicate abrasive conditions, movement and alignment; motor load, etc., assure precise results, dependable grinding production.

Get all the facts. Write for the Besly DH4 Bulletin, Now!

MMT·PE

BESLY®

BESLY-WELLES CORPORATION

120 Dearborn Avenue, South Beloit, Illinois

Grinders and Abrasives • Taps • X-Press Taps® • Drills, Reamers • End Mills • Tool Bits Gages • Carbide Tipped Tools, Blanks, Inserts and Holders

No Grinding... No Blade Resetting

NEW KENDEX* MILLING CUTTER USES THROW-AWAY INSERTS

With a heavy cutter body . . . and more than 5/8-inch of solid Kennametal* backing up each insert . . . new Kendex Milling Cutters are built for the rugged service necessary for fast metal removal. The one-piece cutter body is made of heat treated steel. A 15-degree corner angle minimizes pressure on the workpiece. Solid Kennametal wedges and seats provide close-tolerance, positive positioning of the insert . . . to permit maximum utilization of available power.

Get more information. For dimensional specifications and prices, ask your Kennametal Representative, or write for Supplement No. 9A to our Metalworking Catalog. KENNAMETAL INC., Latrobe, Pa.

*Trademark

Each 3/4-inch square Kennametal insert provides eight separate cutting edges. When one edge becomes dull, the clamp is released and the insert given a quarter turn to a new, sharp edge. It is then reclamped, without need to reset or gage the tool. When all eight edges (four on each side) have been used, the insert is replaced by a new one.

Retracting the wedge, by means of a double-end screw, quickly releases the inserts. *Held in by the screw, the wedge cannot fall out,* regardless of the cutter body position.

INDUSTRY AND KENNAMETAL
...Partners in Progress

Field Report . . .

Electronic Specialty Co Gets Starfighter Component Orders

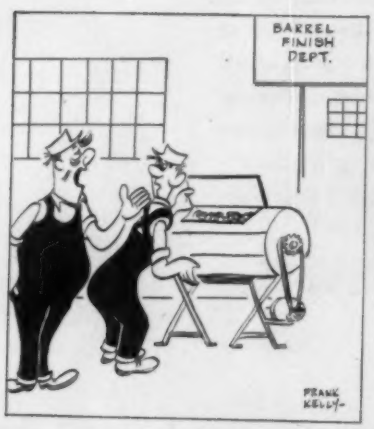
Electronic Specialty, Los Angeles, has received initial contracts of $2.5 million from Canada, Germany, and Belgium for electrical and electronic equipment for the F-104 Starfighter. Lockheed Aircraft, developer of the Starfighter, anticipates manufacture of 1000 of the planes by Canada, Japan, Netherlands, Belgium, and Germany. Electronic Specialty to date has received orders for proprietary products to be installed on approximately 300 of these aircraft.

California Anodizing Co. . . .

. . . has been organized in South San Francisco. New firm, specializing in treatment of aluminum products, is located in Lindenville Industrial Park. Facility, equipped to do color anodozing and clear alumiliting as well as conversion coating, is the largest in the Bay Area for treating aluminum products used in aircraft and missiles, electronics, and construction industries.

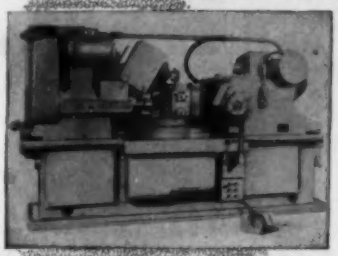
American Brake Shoe's . . .

. . . Kellogg Division, Rochester, NY, is moving to southern Calif. It has purchased a 100,000 sq-ft building at Oxnard in the Los Angeles area. Division provides both engineering services and products for aircraft and missiles and most of its customers are on the West Coast. Kellogg has sold its 200,000 sq-ft facility in Rochester to Friden Inc, San Leandro, Calif, parent company of Commercial Controls Corp, which operates a plant adjacent to the Kellogg building.



"Boy—am I tired—I tumbled in my sleep all last night!"

GOSS and DE LEEUW
AUTOMATIC CHUCKING MACHINE



means a complete piece... at each index cycle

When a piece is finished it is *completely* finished without the necessity of a second operation. Furthermore, it means *more* finished pieces in a given period of time and greater accuracy in *every* finished piece.

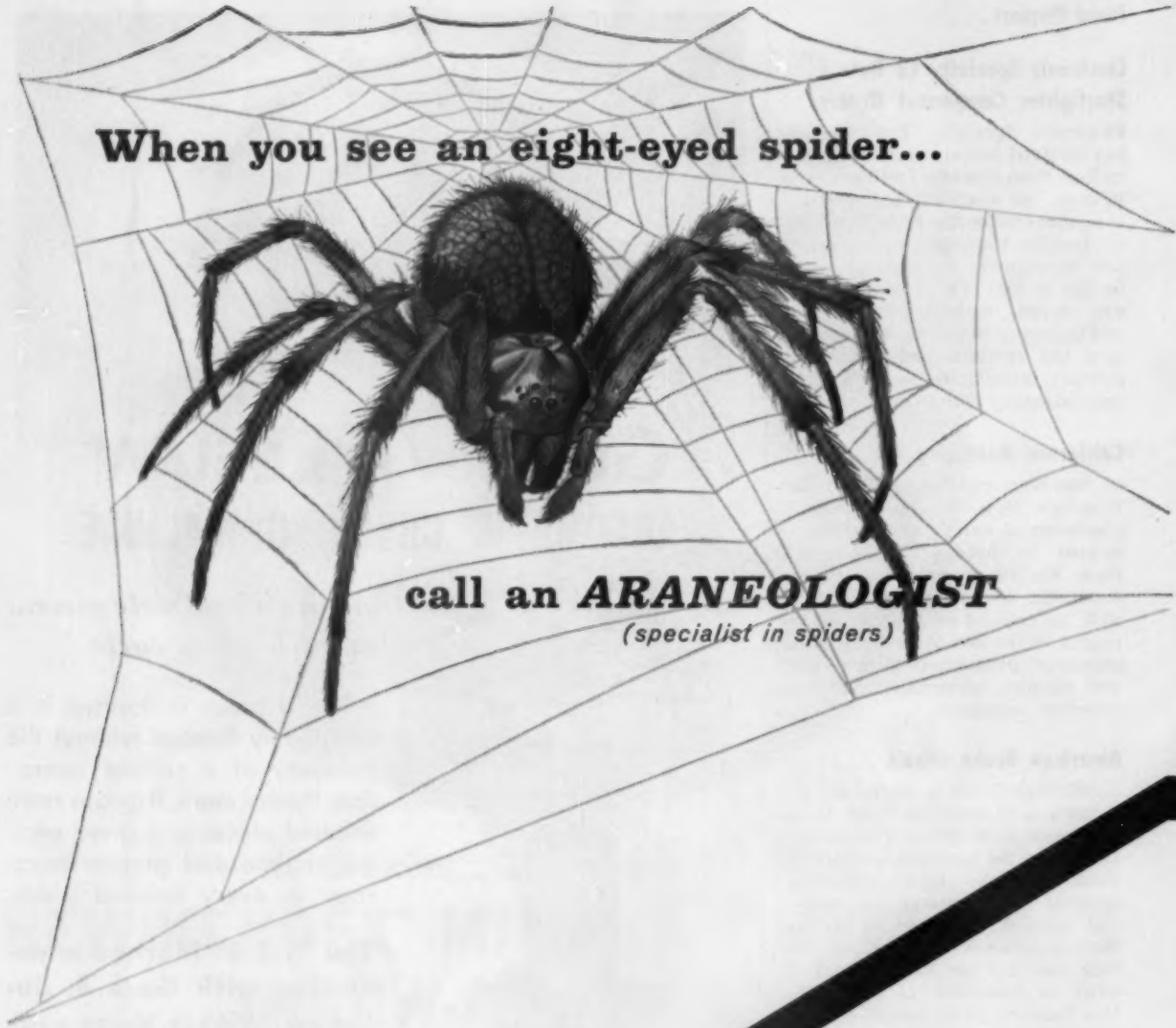
The "1-2-3" Method is exclusive with Goss & DeLeeuw. With it, three ends of a piece can be machined at a single chucking of the work, simultaneously or in sequence depending on the operations involved. It will pay you to investigate.

Send for illustrated literature giving detailed information. Send samples and ask us to give you cost estimates of handling this work on a "1-2-3" Goss & DeLeeuw Automatic Chucking Machine.

MMT-PE
Booth No. 348

GOSS & DeLEEUW
QUALITY PRODUCT-QUANTITY

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.


When you see an eight-eyed spider...
call an ARANEOLOGIST
(specialist in spiders)

when you've got welding problems... call in *LINCOLN*

(specialists in arc welding)

A SOUTHERN sheet metal fabricator had "burn-thru" in the welds. The LINCOLN Field Engineer recommended Fleetweld 37 and licked the "burn-thru" problem. But more important, the new electrodes increased welding speeds to such an extent that overall costs dropped a third.

And right there is a good reason for doing business with LINCOLN. Ideas to whip knotty production problems come naturally to the Field Engineers. They are factory-trained where they—and everyone else—gets paid according to his individual contribution to the company's goal—superior products and service to you at continually decreasing costs. So, while he knows welding, he also understands how to relate it to your total manufacturing operation.

That's why we say it's a good idea to do business with LINCOLN where arc welding is a specialty and cost reduction comes to you as a "plus" at no charge.

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AND **DEPENDABILITY**
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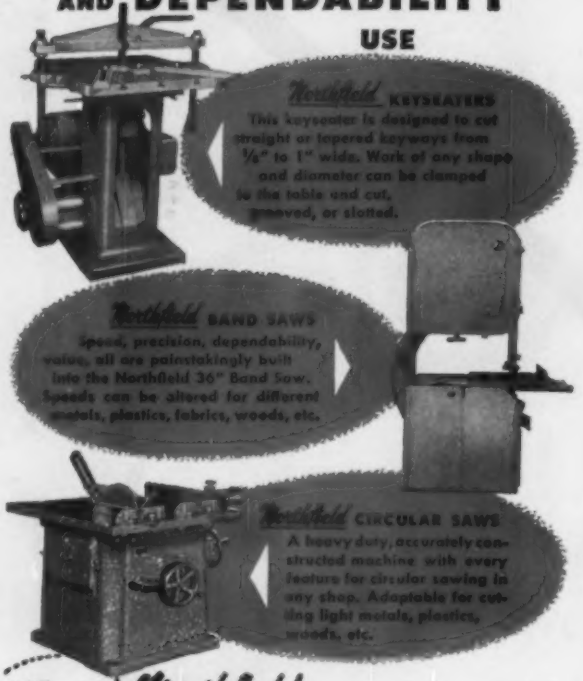
Northfield KEYSEATERS
This keyseater is designed to cut straight or tapered keyways from 1/8" to 1" wide. Work of any shape and diameter can be clamped to the table and cut, grooved, or slotted.
Northfield BAND SAWS
Speed, precision, dependability, value, all are painstakingly built into the Northfield 36" Band Saw. Speeds can be altered for different metals, plastics, fabrics, woods, etc.
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A heavy duty, accurately constructed machine with every feature for circular sawing in any shop. Adaptable for cutting light metals, plastics, woods, etc.

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Machine lapping is always important —no one uses the process unless it is. And, as makers of the first commercial abrasive compound, Clover knows that the kind of lapping compound you use can make a vast difference in efficiency as well as in finish.

Only testing can prove out the best combination of lap speed, grain, vehicle and pressure. But one thing is sure: you might as well have Clover's 50 years of tests behind you when you start your own.

Check with Clover on lapping and grinding problems. The hardest lapping jobs often respond to an answer that was worked out for something entirely different. Use Clover's experience for a starter — *write for suggestions and samples.*

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Norwalk, Connecticut

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MACHINES AND ATTACHMENTS

1 THREADING LATHE—*Gisholt Machine Co, 1245 E Washington Ave, Madison 10, Wis.* 4-page bulletin 1226 covers the Cri-Dan Model E, a high-speed, semi-automatic unit. Lathe, using single point carbide tools, and designed with positive cam-controlled movements, generates very accurate lead and thread forms of all types including single or multiple start, coarse or fine, LH or RH, straight or tapered, and either internal or external.

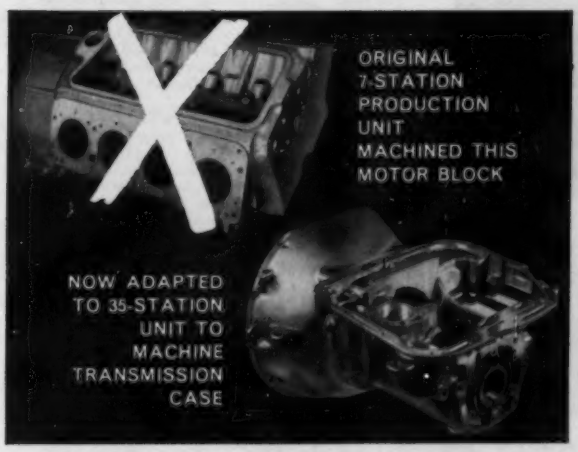
2 AUTOMATIC TURRET LATHE — *Pratt & Whitney Co, Charter Oak Blvd, West Hartford 1, Conn.* 12-paged bulletin 177 gives details on the Potter & Johnston 3E-15. Features include 15-hp headstock; selector-switch cross slide control for faster setup and greater flexibility of cycle programming; optional tape control; 6-face turret; independent motor drive for turret indexing. Swing over base ways is 21-½ in. dia, over cross slides (for machining) 11-½ in. dia, over cross slide base (for chucking) 13-½ in. dia. Spindle speed range (standard) is 60 to 1540 rpm. There are 4 automatic speed changes and 6 automatic feed changes for each set of change gears.

3 OPEN BACK INCLINABLE PRESSES—*Federal Press Co, Division St, Elkhart, Ind.* 20-page catalog 1015 pictures and describes newly designed line in sizes from 7 to 125-ton capacities, all available in either geared or flywheel types. Includes technical information on company's new friction-type air clutch, chain or gear-driven dial feeds, and special presses.

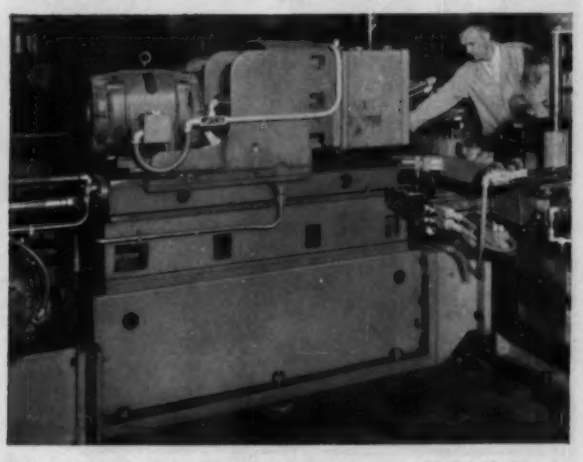
4 MINIATURE INTERNAL GRINDER—*Bryant Chucking Grinder Co, Springfield, Vt.* 6-page illustrated catalogue provides detailed information on Model B Centalign designed specifically for grinding of miniature and instrument bearing races. Two versions are available, one for grinding ball tracks and one for grinding bores. Each requires only 8-¼ sq ft of floor space. Two spindles are available, one from 60,000 to 100,000 rpm, the other from 100,000 to 150,000 rpm.

"Yeh, he said he'd give me a raise. And then he asked me how I wanted it . . . out the window or out the door."

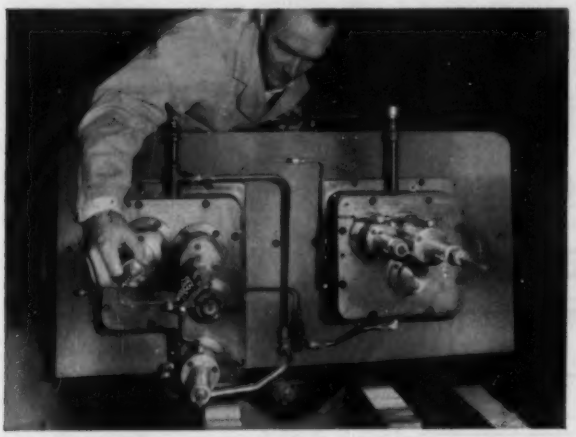
How BARNESDRIL Transfer Machines Save Money Through Flexibility!



BarnesdriL units regroup easily . . . economically. A leading automobile manufacturer, for instance, is reducing the costs of tooling for a new transmission case by using BarnesdriL units from an obsolete motor block line built to the "Building Block" principle. "Before and after" parts are illustrated.



This "obsolete" unit will go right on producing! That's because BarnesdriL unit and slide assemblies are separate. Base and column sections are separate, too, for widest possible flexibility. Units have inserted hardened and ground steel ways, with saddle type construction to reduce height of auxiliary heads.



By simply replacing the "pot" this unit can be adapted to major styling changes. All "pot type" heads are used on this line. Pallets used to hold the work fixtures also can be re-used when the machine is rebuilt. Since pallets rise very little from the rest pad for indexing, they automatically sweep chips into the flume.

This duplex milling head is combined with drilling, tapping, reaming, boring, and facing units on the new 35 station machine. Gross production rate is one case every 36 seconds. For easy maintenance, hydraulic cylinders on BarnesdriL units can be removed by loosening 4 bolts and uncoupling the tie rod.

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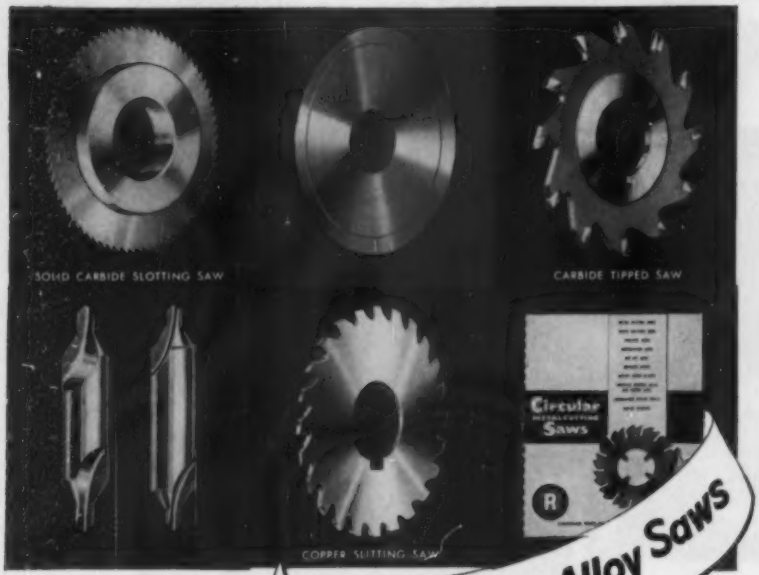

Circoloy Special Alloy Saws

401-9

CIRCLE R Circoloy saws greatly outperform HSS in service life, longer production runs, superior cutting, lower cost — and they're rendered shock-resistant, non-brittle by exclusive Circle R Heat Treating. As catalogued among 1200-plus items, or designed especially on order.

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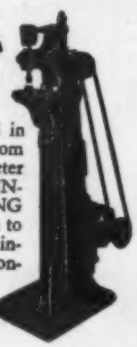
CIRCLE 281 READER SERVICE CARD

GRANT



RIVETERS — PIONEERS in their line — head rivets from smallest to ¾" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method — Sizes to meet all needs — Types include Vertical and Horizontal Multiple Spindles.

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THE GRANT MFG. & MACHINE CO.

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Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

5 DRILLPRESSES — *Rockwell Manufacturing Co, Delta Power Tool Div, 473 N Lexington Ave, Pittsburgh 8, Pa.* 12-page bulletin 100M provides data on new line of Delta 20-in. power feed (upfront control combined with one-hand operation) units available in 18 models including bench, floor, multiple-spindle, and as an overhead track-mounted tool. Includes specifications and listing of available components and accessories.

6 OFFSET BORING HEADS—*Everede Tool Co, 2000 N Parkside Ave, Chicago 39, Ill.* 8-page catalog BH2-59 pictures and describes line that can bore deep or shallow with one standard length boring bar; they are interchangeable for use on jig borers, boring mills, or turret lathes. Covers heads, attachments, jig boring bars, interchangeable shanks, adapters, and toolbits.

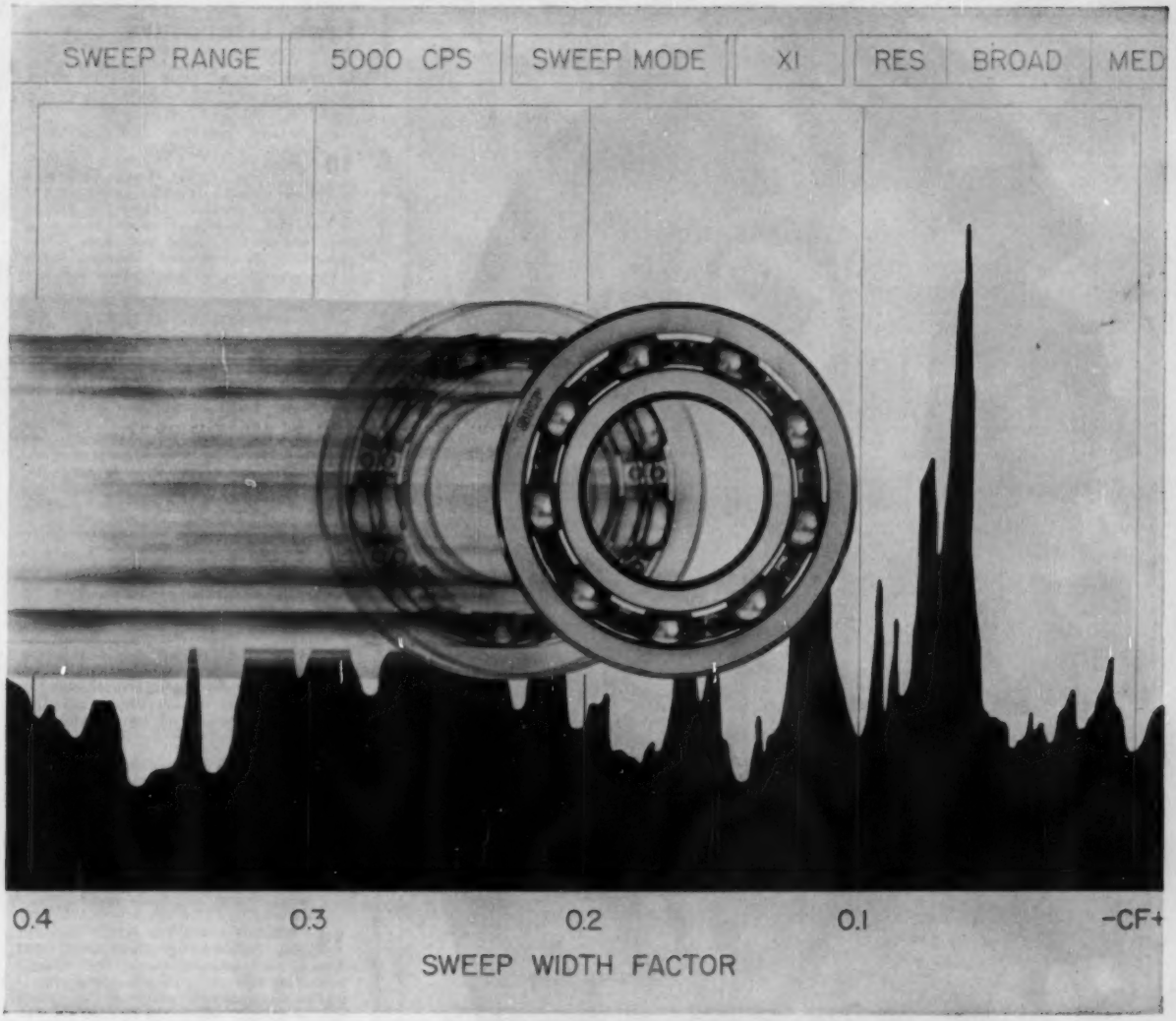
7 SHELL INVESTMENT CASTING TECHNIQUE—*Engineered Precision Casting, PO Box 68, Matawan, NJ.* 4-page illustrated brochure describes Shell-Kote, a technique which utilizes a highly refractory, relatively thin coating of ceramic around a disposable pattern as the molding medium. Discusses advantages, tells how it differs from conventional techniques, and why it is an improvement.

8 LIVE CENTERS—*J & S Tool Co, 37 Dorsa Ave, Livingston, NJ.* 12-page folder pictures and describes new line with accuracy better than 0.0001 in.

TOOLS AND ACCESSORIES

9 CUTTING TOOLS—*Brown & Sharpe Mfg Co, Cutting Tool Division, Providence 1, RI.* 128-page general catalog 38 is divided into two separately bound catalogs, one for HSS and carbide end mills, and one for HSS and carbide milling cutters. Separate, complete catalog of Nelco solid carbide and carbide tipped end mills and cutters is also available. Each catalog contains tool design data; tolerances; features; materials to cut; production uses; and dimensional drawings. Sections included in each subject catalog cover speeds and feeds, tool selection tables, and engineering data on resharpening most tools. Specific catalogs are: 38E, 52 pages on end mills; 38C, 40 pages on milling cutters; 38N, 36 pages on carbide tools; and 38, 128-page general catalog.

"Lately he just doesn't seem to know where to draw the line."



Now, SKF reduces the noise level of ball bearings by 50%!

New SKF ball bearings run twice as quietly as standard single-row deep-groove bearings — six times more quietly than bearings produced just two years ago.

They're designed especially for applications where noise is an important factor. Eight manufacturers, who use-tested them for over a year, now back-up their approvals with repeat orders.

Every bearing meets new, more critical standards. Each type and size meets special requirements for reduced vibration. Every ball meets very low waviness limits. Each cage meets critical standards for smooth, quiet performance.

SKF will make a comparison check of these improved bearings against the bearings you're now using. See for yourself! Just call the SKF branch office nearest you. 6013

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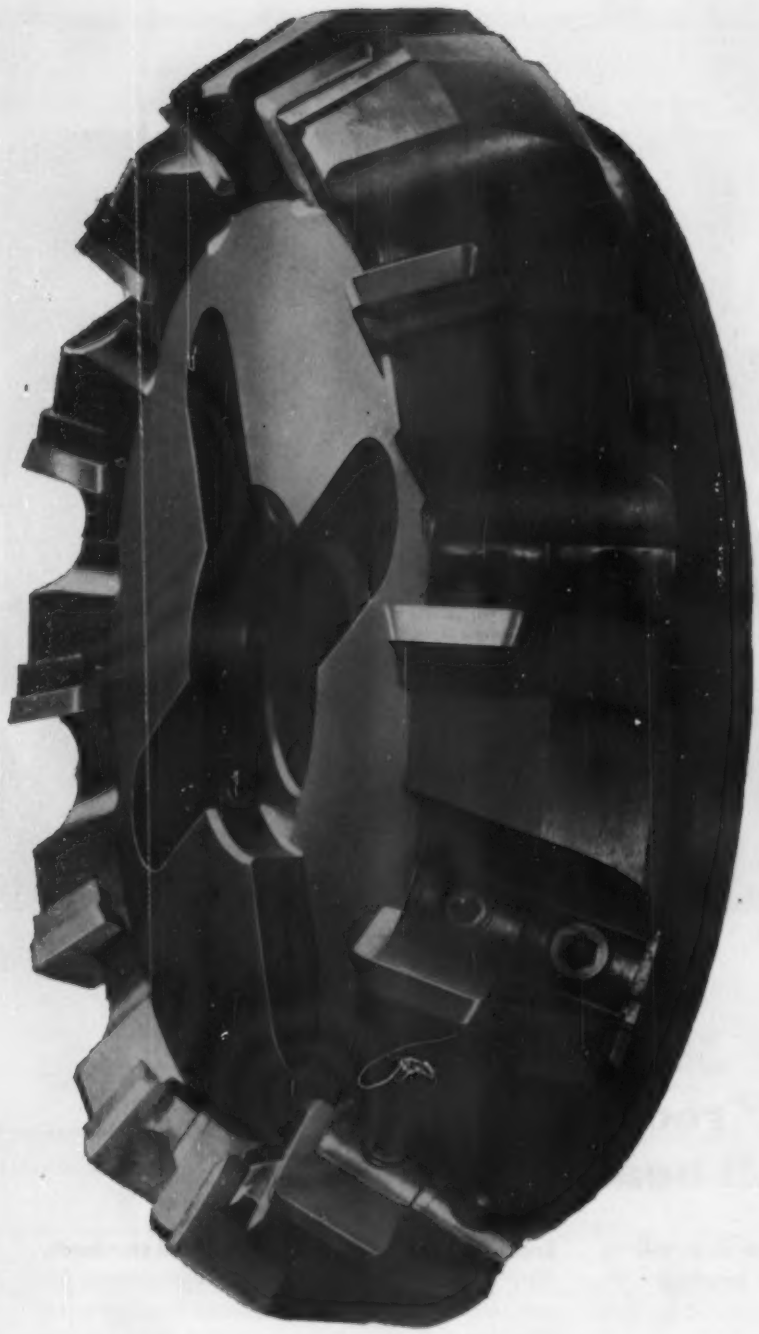

How efficient are Joydex cutters? We quote from a recent performance report: "Facing and rough milling a chrome-moly vanadium casting (Brinell 250) to a depth of ⅞" at cutting speed of 200 SFPM, the 12" dia. Joydex milled approximately 300 cu. in. per blade edge. Performance was beautiful."

Send for "Joydex" Catalog.

LOVEJOY TOOL COMPANY, INC.
Springfield, Vermont, U.S.A.

Free Literature

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10 "SAWOLOGY"—*Nicholson File Co, Providence 1, RI.* 34-page illustrated handbook covers selection and use of hacksaw and bandsaw blades for cutting ferrous and non-ferrous metals, hard plastics, and rubber, wood and other dense materials. Pictures and describes blade types, provides recommendations on use and care, includes bandsaw blade and tooth selectors.

11 HEIGHT GAGE—*US Chemical Milling Corp, 1700 Rosecrans Ave, Manhattan Beach, Calif.* Illustrated brochure on the portable Height Master and its accessories describes features of the new gage which is specifically designed for use in inspection, precision layout work, and checking jigs and fixtures. Instrument gives accurate measurements to 0.0001 in. and eliminates need for gage blocks and transfer gages. Standard and oversize gages, from 17 to 108 in. are availabe.

12 LUBRICANTS — *Elco Lubricant Corp, Jennings Rd & Denison Ave, Cleveland 9, Ohio.* 12-page Lube/Report 102 presents detailed information on factors involved in selection and use of lubricants for industrial plant machinery. Case study presented on use of SCL-type lubricants in four steel plants; after 22 years, the lubricant performance record is reported as perfect. Lubrication practices and properties of SCL lubricants which produced this record are described.

13 DIAMOND TOOLS—*Staset Co, West Orange, NJ.* 36-page illustrated catalog 460 contains diagrams, specifications, and pricing information on 232 standard diamond tools. Sections cover cluster and impregnated tools, radius dressing tools, boring and turning tools, Staset rib-nib mounting, wheel type tools, grit and tandem tools, and blade tools.

14 HEAT-TRANSFER OIL — *Sun Oil Co, Industrial Products Dept, 1608 Walnut St, Philadelphia 3, Pa.* 2-page technical bulletin gives complete information on Sun 21, including properties and advantages which include high thermal efficiency; high thermal stability; easy circulation; low pressure operation; absence of offensive odors; long service life.

15 CERAMIC GAGES—*Greenfield Tap & Die Corp, 100 Sanderson St, Greenfield, Mass.* Illustrated literature lists advantages which include long wear life, high abrasion resistance, low coefficient of friction, and low affinity for metals. Available in thread plug, plain plug, plain ring, and plain master discs. Applications described.

16 CARBIDE CUTTING TOOLS—*Wesson Co, 1220 Woodward Heights Blvd, Ferndale 20, Mich.* 12-page bulletin MF-360 describes carbide-tipped shell end mills, straight and taper shank end mills and reamers, core drills, lathe centers, and counterbores. Also provides detailed information on two models of Wesson universal angle vises for machine tools and bench operations.

17 COMPARATORS—*David W Mann Co, Div of Geophysics Corp of America, Lincoln, Mass.* 8-page catalog provides information on various types. Specification chart for 10 models provided. Company's special services for precision ruling, both circular and linear, are fully described.

18 HOLE LOCATION GAGE — *Mayes Tool Co, 26514 W Seven Mile Rd, Detroit 40, Mich.* 8-page bulletin M-12 contains illustrated descriptions of Con-Chek hole locating and concentricity gages

available in six standard and six special models. Special Mayes Tool gages using Con-Cheks for checking multiple holes in parts are also shown.

19 "A GUIDE TO BETTER CENTERS"—*High Precision Products, Westfield, NJ.* 12-page booklet contains general background information including function and application; lists and illustrates six errors that a center can have, describes essentials for geometrically true centers, and the art of correcting centers.

HEAT TREATING AND WELDING

20 ELEVATOR FURNACES—*Harper Electric Furnace Corp, 110 Pearl St, Buffalo 2, NY.* Illustrated bulletin EF-260 presents the updated and expanded line equipped with neoprene-sealed retorts. Tabulated specifications cover the 32-model line. Describes chief operating features of the furnaces in providing low dewpoints for brazing, annealing, hardening, and sintering at temperatures up to 2300 F.

21 ARC WELDING GUIDE—*Hobart Brothers Co, Troy, Ohio.* 80-page revised edition of "How to Get Better Welds" is a 6 ½ x 3 ¾ in. booklet that gives information on five essentials for proper welding procedures, welding metals, causes and cures of common troubles, definitions of welding terms, types of joints, eight factors to consider when selecting electrodes, comparative electrode index, typical deposition rates, welding wires and flux, and much other valuable data.

22 MANUAL WELDING EQUIPMENT —*Linde Co, 270 Park Ave, New York 17, NY.* 16-page catalog F-1393 describes new Sigmatic line of welding machines, plus torches and controls, for consumable electrode inert-gas-shielded welding. Illustrated information covers the three popular styles of standard-component Mig welding machines—frame, sled, and cart type units.

23 MESH-BELT FURNACES—*General Electric Co, Schenectady 5, NY.* 4-page illustrated bulletin GED-3881 describes features and advantages of GE ribbon or silicon carbide resistor mesh-belt units for copper brazing, silver brazing, sintering, and bright annealing. Contains tables of dimensions and typical production curves.

PLANT SERVICE EQUIPMENT

24 INDUSTRIAL TRUCK COSTS — *Exide Industrial Division, Electric Storage Battery Co, Rising Sun and Adams Avenues, Philadelphia 20, Pa.* Factual industrial truck cost histories and do-it-

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feature by feature... the latest

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JIG BORER

IS A TOP PERFORMER IN TODAY'S TOOLROOMS WHERE ACCURACY IS ESSENTIAL

1. Accurate to a high degree, the Linley is fast to set up and position and has the versatility required for precision tool work.
2. Ribbon type locks on both table and saddle for positive no-shift locking add to its dependability and lasting accuracy.
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Designed And Built For Precision Operation

The Linley Jig Borer is a precision machine designed specifically for small tool and die work and reasonably priced. It is available with many time saving accessories that add to its usefulness and speed. Table size is 7" x 17½"; table travel, 6½" x 10".

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MODEL C-2

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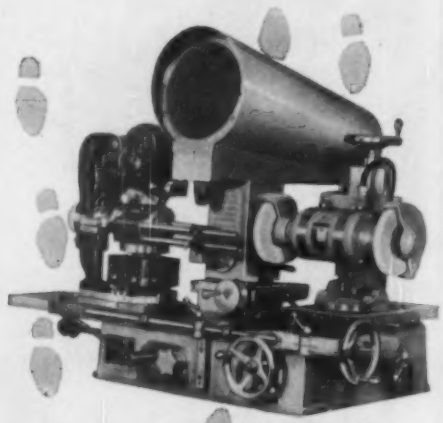

SAVE STEPS!

SAVE TIME!

SET-UP, GRIND, CHECK, FINISH, CHECK— WITHOUT REMOVING THE TOOL, ONCE!

The R-O comparator swings into the work as often as you need it for accurately checking progress of the grind—swings out of the way. Eliminates steps wasted traveling to and from a floor comparator.

Now you can have the basic advantages of form relief sharpening: more cuts per grind, positive control of dimensions on steps, better cutter performance, etc. — plus the added time savings of comparator checking without removing the tool—and you get the bonus of *concentricity*, assured by doing the job in one chucking.

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R-O Grinder

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yourself formulas for quick, accurate calculation and comparison of all expenditures are provided in four complete booklets, 62 pages in all, covering every cost area of truck operation from purchase price to hourly oil expense. Literature tabulates and itemizes costs of owning, operating, and maintaining industrial trucks powered with electricity, gasoline, or propane.

25 MECHANICAL DEBURRING — *Wheelabrator Corp, 1140 S Byrkit St, Mishawaka, Ind.* 4-page illustrated folder (Mechanical Deburring News) describes and diagrams four methods and gives examples of their application. Various types of equipment available include Wheelabrator airless blast machines, Techline barrel finishing equipment, Lorco vibratory machines, and Liquamatte wet blast equipment.

26 PUILDING MAINTENANCE MANUAL — *Johnson's Wax, Service Products Division, Racine, Wis.* 28-page illustrated manual explains characteristics of 12 different floor surfaces; chart outlines special precautions to be observed with each and lists types of products recommended for their upkeep. Covers procedure for cleaning and finishing floors, outlines day-to-day maintenance, discusses special finishes, offers safety suggestions. Other sections deal with general cleaning, including walls, windows, and wash-rooms.

27 VIBRATORY MACHINES—*Almco, Queen Products Division, King-Seeley Corp, Albert Lea, Minn.* Catalog illustrates and provides technical information on seven Vibrasheen machines with tub capacities ranging from ¾ gal to 17 cu ft capacity. Pictures a variety of parts before and after finishing with Almco equipment and methods.

28 FINISHING EQUIPMENT—*Lord Chemical Corp, 2068 S Queen St, York, Pa.* 6-page bulletin 1002 covers Lorco and Techline equipment, supplies, and accessories. Data provided on barrel finishing and wet blast equipment, media, compounds, and abrasives, magnetic and mechanical separators, dip and rinse tanks, and degreasers.

"You learn more as you get older, but by then it's not important.

CIRCLE 287 READER SERVICE CARD

CIRCLE 288 READER SERVICE CARD ►

HOUR OF DECISION

After hours? — sure You're not surprised at that because you know it's when he (and probably you, too) concentrates on the problems which are vital to his company's continued successful growth. The day is filled with production crises, maintenance problems, personnel questions, and committee meetings. It's only now that he can really study the facts and decide what's best.

Right now he's reviewing his machine tool inventory. He's amazed at how old some of his equipment is getting to be. It seems only yesterday that he signed the purchase order for it to increase his capacity for World War II. But that was 1943, seventeen years ago! No wonder maintenance is getting high and efficiency is dropping off.

We've got a suggestion for this man (and for you, too). Attend THE MACHINE TOOL EXPOSITION — 1960 and see for yourself why Modern Machine Tools = Production Efficiency. This exhibit, the first since 1955, is sponsored by The National Machine Tool Builders' Association* and will contain eleven acres of the U.S.A.'s newest machine tools under power, cutting and forming metal to demonstrate 1001 ways to lower production costs. Can you afford to stay home?

You're also invited to the PRODUCTION ENGINEERING SHOW on the Navy Pier.

No extra registration needed.

*The N.M.T.B.A. represents 90% of the U.S.A. machine tool industry.

FORMULA FOR TOMORROW

MODERN MACHINE TOOLS = MMT=PE PRODUCTION EFFICIENCY

International Amphitheatre
Chicago, Illinois
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THE MACHINE TOOL EXPOSITION — 1960

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ED JOHNSON

Furnace Application Engineer, reports . . .

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The effective bonding of powder metal compacts is dependent on precise sintering temperatures, and the properly reactive furnace atmosphere for each temperature range. To assure optimum results at lowest cost, Hayes offers both the *right* furnace and the *right* atmosphere for any sintering operation, whether you're working with ferrous, nonferrous, or refractory metals; stainless steel compacts; or cermets. Hayes furnaces and atmospheres suitable for research, high-temperature, or production sintering, include:

Type BA-M Pusher "Pilot Plant" Furnace. Controlled atmosphere heating and cooling . . . straight-through design. Manual or automatic operation to 2150° F.

Conveyor Furnaces straight-through LAC and Humpback BAC — for continuous, automatic, sintering to 2100°F. Zone temp control. Burn-off sections. For stainless steel, etc.

Type BA High-Speed Pusher Furnace — wide-temperature-range furnace for sintering to 2350° F. Available with automatic, electro-hydraulic pusher system for constant time / temperature cycles.

Type M-Y High-Temperature Furnace for uniform heating of ceramic and metal compacts at temps over 3000° F. Economical — use with reducing atmospheres for close-control research or full-scale production.

Model HT/HV Vacuum Furnace for high vacuum (0.1 micron), high temperature (3000° F plus) sintering special refractory metals—titanium, zirconium, tungsten, etc. High-speed heating and cooling cycles. Cold wall design, low voltage elements.

Atmosphere Equipment . . . ammonia dissociators; endothermic, exothermic, nitrogen, forming gas generators; Molecu-Dryers for drying protective atmospheres to —100° F D.P. Designed for controlled, dependable operation.

Use Hayes experience and equipment to insure a "Results Guaranteed" solution to *your* heat treating or protective atmosphere problem—to improve your product, reduce spoilage, or speed up production. Write for details.

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It pays to see HAYES for metallurgical guidance, lab facilities, furnaces, atmos. generators, gas and fluid dryers.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

29 SAFETY WORK GLOVES—*Advance Glove Manufacturing Co, 901 W Lafayette Blvd, Detroit 26, Mich.* 12-page catalog illustrates and describes complete line in every style and fabric. Gloves are shown which are resistant to water, chemicals, oil, and heat.

PARTS AND MATERIALS

30 STRUBING—*Wolverine Tube, Division of Calumet & Hecla Inc, 17200 Southfield Rd, Allen Park, Mich.* 8-page brochure provides information on this combination of strip and tubing, a type of very light-wall seamless metal tubing. Produced by the company in most metals, it is processed in strip form and rolled up for compact shipment. Explains how mechanical techniques are used to expand the strip into tubular form, the alloys which are presently being worked on, method of fabrication, and size range.

31 BRAKES AND CLUTCHES — *Warner Electric Brake & Clutch Co, P-78, Beloit, Wis.* Complete-line product brochure, "Tailored Torque," explains the Warner Electric operating principle, describes several clutch, brake, and clutch-brake applications, outlines specific operating advantages, and includes torque ratings and package dimensions.

32 AC MOTORS — *Sterling Electric Motors Inc, 5401 Telegraph Rd, Los Angeles 22, Calif.* 56-page catalog illustrates and describes ac multi-shielded motors ranging from ¼ to 200 hp. Information included for various modifications, such as specialized mountings and enclosures, as well as the new Sterlicone multi-shielded drip-proof units. Pricing and dimensional data included plus selection and application information.

33 SPEED VARIATOR—*General Electric Co, Schenectady 5, N.Y.* 8-page bulletin GEA-7018 covers GE's new General Purpose Thymotrol speed variator, including details of standard and optional features. Describes the adjustable speed drive which uses the Thyratron tube to convert ac to dc power. Suitable control is included in the panel to vary armature voltage and thus motor speed over a wide,

"I got my raise after convincing the boss that I do two men's work. Sorry I had to drag your name into it, Wilkins."

Invented by **THOMSON**

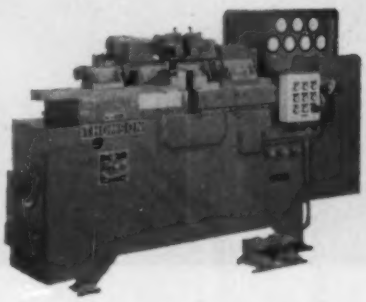
Perfected by **THOMSON** *Resistance Welding*

Spot • Projection • Seam
• Press • Flash-Butt
• High-Frequency

plus **EXCLUSIVE**

Synchro-matic and Synchro-shear*

...for jobs no other resistance welders can do



THOMSON QUALITY is so important that we build our own transformers to assure maximum performance and reliability. For all **AUTOMATED** and **HIGH-PRODUCTION** requirements — either special or standard design — **THOMSON QUALITY** is within your budget. A **THOMSON** quote will prove it.

* patented

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Inventors of Resistance Welding

THOMSON ELECTRIC WELDER COMPANY

361 PLEASANT STREET, LYNN, MASSACHUSETTS

LYnn 2-7710

PARTS BY THE THOUSANDS . . .

Left to right: Plastic tubing, rings and formed spacers, coupling blanks, heavy pipe nipple blanks, standard pipe nipple blanks.

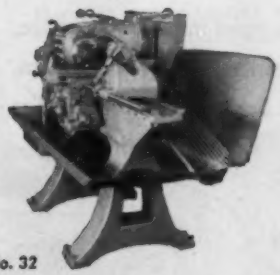
Formed . . . Chamfered . . . Cut-Off on BARDONS & OLIVER Cutting-Off Lathes

Superior Pipe Specialties Co., Chicago, reports a *ten year* profit success using Bardons & Oliver Cutting-Off Lathes.

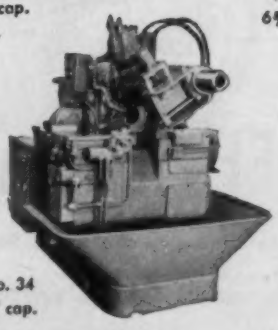
The firm produces parts for their hydraulic equipment plus a wide variety of products on a jobbing basis.

Says Mr. Youhn, Factory Superintendent: "Bardons & Oliver Cutting-Off Lathes are the *only* machines of this type that will stand up under years of hard use. We are completely satisfied with them in every respect."

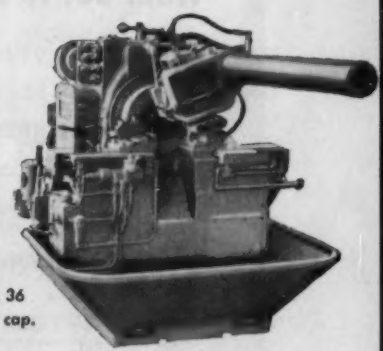
As the above photograph suggests, "versatility" is the name for these Bardons & Olivers. They're unexcelled for forming, chamfering and cutting-off tubular or solid bar stock. You realize extra profits by using these outstandingly rugged machines in your plant. Available in collet capacities from 2 to 16 inches, with automatic loading and unloading equipment if desired.
Bardons & Oliver, Inc., 1133 West 9th Street, Cleveland 13, Ohio.



No. 32
2" cap.



No. 34
4" cap.



No. 36
6⅝" cap.

OPERATING DATA FROM SUPERIOR

Typical hourly production
- No. 32 — 4000 - ½" pipe nipples chamfered & cut-off.
- No. 34 — 1082 - 2" pipe nipples chamfered & cut-off.
- No. 36 — 240 - 5" pipe nipples chamfered & cut-off.

Tolerances held on lengths: ±.002"

Average set-up time: 20 minutes

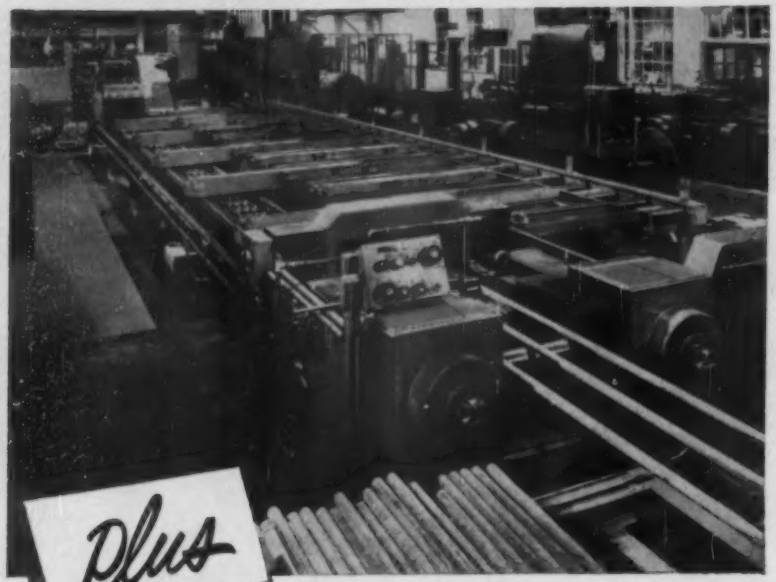
Tooling
High speed steel, carbide or roller cutter, depending on finish desired, material, operations performed and lot size.

Operators Required
2 men operate 3 machines, including setup, loading, and unloading (With automatic handling equipment 1 man can run 3 machines).

BARDONS & OLIVER

Manufacturers of Turret Lathes and Cutting-Off Lathes

MODERN FACILITIES-



Plus

CONSTANT QUALITY AND METALLURGICAL CONTROL in every step of processing

. . . assure positive uniformity from bar to bar—order to order

Four modern, well-equipped mills at Ambridge, Pa.; Chicago, Ill.; Newark, N.J.; and Putnam, Conn., insure prompt deliveries and service for all of your cold drawn steel requirements.

***For the finest in Cold Finished Steels always . . . specify* WYCKOFF!**

SPECIALISTS IN COLD FINISHED STEELS EXCLUSIVELY

WYCKOFF STEEL COMPANY

GENERAL OFFICES:
Gateway Center, Pittsburgh 30, Pa.

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Works: Ambridge, Pa., Chicago, Ill., Newark, N.J., Putnam, Conn.

WYCKOFF STEEL PRODUCTS • Carbon, Alloy and Leaded Steels • Turned and Polished Shafting • Turned and Ground Shafting • Large Squares • Wide Flats up to 12¾" x 2¼" and 14" x 1¼" • All types of Furnace Treated Steels including Carbon Corrected Steels

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

stepless range. DC motors used with these drives are specially designed to give maximum performance on rectified power.

34 TORQUE-LOCKING DEVICE — *Formspray Co, 22601 Hoover Rd, Warren (Detroit), Mich.* 12-page bulletin pictures and describes dual torque-locking and positioning device to drive, position, over-run, and backstop in clockwise and counter-clockwise directions and, in addition, automatically and positively prevent torque feedback from either direction. Specifications and applications covered.

35 MACHINERY MOUNTS—*Korfund Co, 48-20B 32nd Pl, Long Island City 1, NY.* 6-page bulletin K3C provides latest data on stopping vibration, shock, and noise transmission by using steel spring machinery mountings. Data tables give capacities and characteristics of Series L Vibro-Isolator, including sizes, load capacities, dimensions. Describes the many variations available in Korfund mountings to meet a range of difficult operating conditions. Typical installation arrangements illustrated.

36 MOTOR SELECTOR—*Howell Electric Motors Co, Howell, Mich.* 8-page brochure L-1661A contains illustrated data on complete motor and generator lines. AC motors range from 1/40 to 300 hp including complete line of standard motors plus designs for wide variety of special applications. Also lists horizontal-shaft and right-angle gear-motors, coupled-unit speed reducers, generators, motor-generators, frequency changers, and industrial bench grinders.

37 TUBING—*Pacific Tube Co, 5710 Smithway St, Los Angeles 22, Calif.* 20-page illustrated catalog 60 details materials, size ranges, mechanical and physical properties, tolerances, lengths, specifications, material selection and applications of mechanical, pressure, and aircraft tubing. Both seamless and welded tubing are detailed in sections pertaining to carbon, alloy, and stainless steel grades. Shaped tubing, small specialties, as well as a section on special finishes, custom tubing, and bimetallic tubing are included.

38 METER-RELAY—*Assembly Products Inc, Chesterland, Ohio.* 4-page illustrated bulletin S-2-1 describes the CRMR, a new kind of meter-relay combining continuous signal indication with reliable control action and instantaneous reset. Diagrams show how various circuit components are affected during the operation.

"What do you mean . . . 'So this is a blue print?' . . . Where did you say you served your time . . . ?"

39 BERYLLIUM TUBING — *Superior Tube Co, 1563 Germantown Ave, Norristown, Pa.* Data Memorandum 26 gives complete information on available sizes and unusual properties of pure beryllium tubing. Included are its physical and mechanical properties and composition limits of the material from which the tubing is made.

40 CLAMPS — *Wittek Manufacturing Co, 4305-43 West 24th Pl, Chicago 23, Ill.* 16-page illustrated booklet contains condensed information on many types of standard clamps for hose, flexible plastic pipe, and duct connections. A number of custom-made clamps for unusual applications are also described and pictured.

MEMOS

by BESS RITTER

One of the more important Greek inventions of the 5th century BC would never have come into being at all if the orators of the country hadn't talked so much. This invention was known as the clepsydra (water clock) and it was needed because too many lawyers and too many orators made speeches at court and in the governmental assembly that lasted seven hours and more.

The first such water clock was a simple container with a big hole at the top and a tiny one near the bottom, and water was poured in through the first hole. When it dribbled out of the second hole and left the container completely dry, the speaker was supposed to conclude his speech.

Consequently, he was very careful to use every precious moment that this device allowed him: If he was interrupted by a question from the audience, he would shout to the attendant, "Stop the water—please!" If this wasn't permitted, and the question was a long one, this person was told very courteously but firmly, "Remember, Sir, you are in my water."

The Greeks also relished the little story about a boring orator who stopped every few minutes to take a drink, until an impatient listener shouted out, "Drink your water from the clepsydra—and you'll refresh your audience as well as yourself!"

Eastman Kodak uses...
FEDERAL-WARCO
At Eastman Kodak, Warco straight-side presses turn out millions of close-tolerance, high-quality parts for Kodak cameras and motion picture projectors.
Precision, quality and high volume are Kodak watchwords. Federal-Warco plays a vital role in helping Kodak meet its rigid production requirements consistently.
THE FEDERAL MACHINE AND WELDER COMPANY
Warren, Ohio
Federal WELDERS
Warco PRESSES

MATTISON
HIGH-POWERED PRECISION

GRINDING METHODS

"Revolutionary" surface grinding method combines accuracy, high productivity

The pump piston cover assemblies below illustrate how a new method grinds pieceparts to flatness tolerances of .0005", removing .004" of stock . . . at a production rate of 140 per hour!

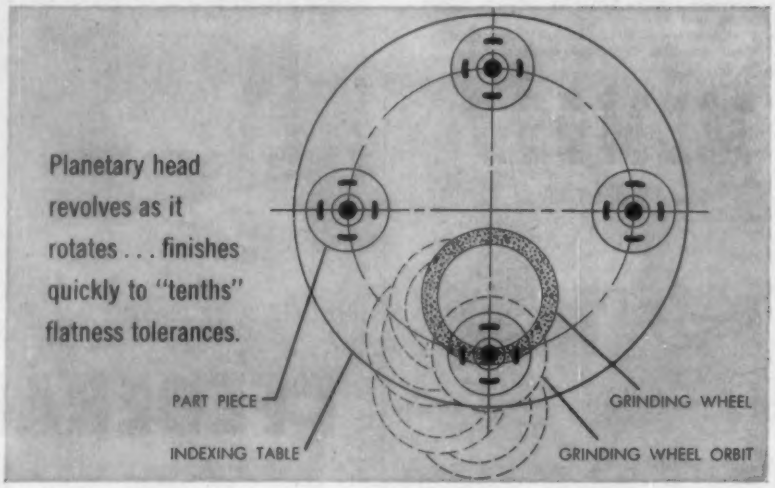
The high-production grinder—Mattison's new rotary *indexing* model—has a planetary head which orbits around the center point of work held by stationary fixtures as they index under the wheel. Here's why this new method can economize *your* grinding for flatness.

1 Equipment costs are lower because it is easier to revolve a spindle than to spin work with separate drives.

2 Holding the piecepart stationary in its fixture keeps work properly oriented for simple loading, transferring, and unloading without danger of mislocation. The process is ideally suited for grinding from the rough on transfer-type machines.

3 Continuous cutting, an advantage of the index-type worktable, increases machine use and production rates.

4 Thin parts, normally resilient under a heavy cut, now can be ground accurately. The cylinder wheel covers a large work surface evenly, reduces pressure on any one section—virtually to zero as the machine sparks out.


Planetary head revolves as it rotates . . . finishes quickly to "tenths" flatness tolerances.
PART PIECE
INDEXING TABLE
GRINDING WHEEL
GRINDING WHEEL ORBIT

Planetary principle speeds production

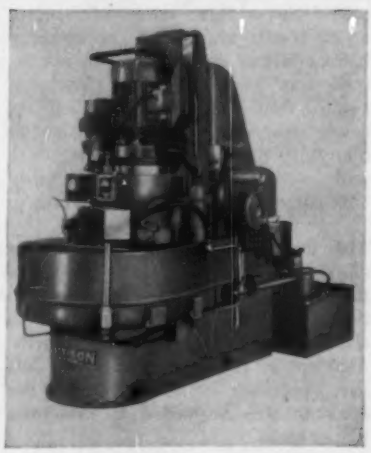
Mattison's planetary head grinder is similar in principle to cutting with a conventional rotary vertical spindle surface grinder. Instead of the piecepart spinning under a stationary spindle, however, it remains fixed and lets the wheel axis revolve around its center point at 60 rpm—approximately in the same speed at which work rotates on a standard machine.

In the grinding job illustrated, work is held by almost zero clamping pressure. This prevents distortion, while holding the parts snugly against stops. Grinding pressure forces the parts *down* against locating surfaces of the fixtures. Loading and unloading are accomplished easily, even while working at very high production rates.

Either fixtures or magnetic chucks may be used, depending on the piecepart shape. Both methods orient work for other stations in index-type, around-the-table, or transfer-type machines requiring vertical, horizontal, or angular-mounted grinding heads.

Mattison's 24AP planetary grinder uses self-dressing wheels. Once the wheel has been trued during initial setup, wear takes place evenly so that perfect flatness results. A post-process gaging system actuates an independent automatic feed for controlling work size.

The planetary wheel head houses either one or two spindles, depending upon production requirements. An auxiliary motor drives the spindle assembly through "V" belts, while the main wheel head motor powers the spindle itself through a timing belt, which revolves radially as it drives.



Mattison No. 24AP permits combinations of grinding with drilling, boring, reaming, and tapping on such parts as electric motor frames, valve bodies, transmission housings, and engine blocks.

Need integrated grinding precision?

If you need precision grinding integrated for assembly-line production, contact your Mattison representative or write to us direct for complete details on the No. 24AP planetary surface grinder.

MATTISON MACHINE WORKS
Rockford, Illinois Phone: WO 2-5521

MATTISON MACHINE WORKS

HIGH-POWERED PRECISION SURFACE GRINDERS

Cincinnati Milling Machine Co has elected **Philip O Geier Jr** vice president and appointed him assistant general manager. He was formerly manager, Products Division

Burg Tool Manufacturing Co, Gardena, Calif, has named **Roland Hecker** chief engineer. He was formerly associated with Lodge & Shipley Machine Tool Co, Cincinnati

Brown & Sharpe Manufacturing Co, Providence, RI, has announced the retirement of **James Meehan** after 43 years of service with the company. In 1948 he was placed in charge of grinding machine sales and two years later was named director of grinding and milling machine sales. During the past five years Mr Meehan has been assistant to the general sales manager of the Machine Tool Division

NAMES IN THE NEWS...

Abbey Etna Machine Co, Perrysburg, Ohio, has appointed **Stanley L Nitkiewicz** vice president, engineering. **V H Sanner** has joined the company as director of sales.

American Machine & Foundry Co, New York, has named **E M Lester** head of the Buffalo Division plant. Mr Lester is director of manufacturing for the AMF Government Products Division.

Cleveland Cap Screw Co has elected **Thomas A Fribley** president of the firm. Formerly executive vice president, he succeeds his father, **Joseph W Fribley,** founder of the company, who died June 6.

Morton Manufacturing Co, Muskegon Heights, Mich, has elected **Jack E Morton** vice president, purchases. He was formerly assistant secretary.

Vickers Inc, Detroit, has appointed **Duncan B Gardiner** manager, corporate engineering. He was previously director of research and development.

Worthington Corp, Harrison, NJ, has appointed **Eric A Bianchi** general manager of the Mason-Neilan Division, Norwood, Mass, manufacturer of automatic valves and instruments. Mr Bianchi has been vice president, engineering and manufacturing, of the division since 1956 when it became an operating division of Worthington.

Minneapolis-Honeywell Regulator Co has named **Charles S Marshall** manufacturing superintendent of the Rubicon Division, Philadelphia producer of precision calibration and test instrumentation.

Chrysler Corp has named **W C McDonald** chief engineer of the Marine and Industrial Engine Division. Previously resident engineer of the Chrysler Mound Road engine plant, he succeeds **H D Peacock** who has resigned.

Gisholt Machine Co, Madison, Wis, has promoted **Werner I Senger** (left) from vice president in charge of balancing to vice president, engineering. **George M Class,** a vice president in charge of engineering since 1955, will now devote his efforts to increased customer relations, patent administration, and special projects as well as serve in a general advisory capacity. **John C Weston** (right), chief inspector, has been appointed production manager to succeed **Woodbridge Bissell** who has retired

Norwalk Powdered Metals Inc, Norwalk, Conn, has elected **Roy Jamison** a vice president of the company. He was formerly associated with Hoeganaes Sponge Iron Corp.

American Drill Bushing Co, Los Angeles, has named **Andrew M Mezey** midwest manager. He was formerly associated with the J H Williams Division of United Greenfield Co.

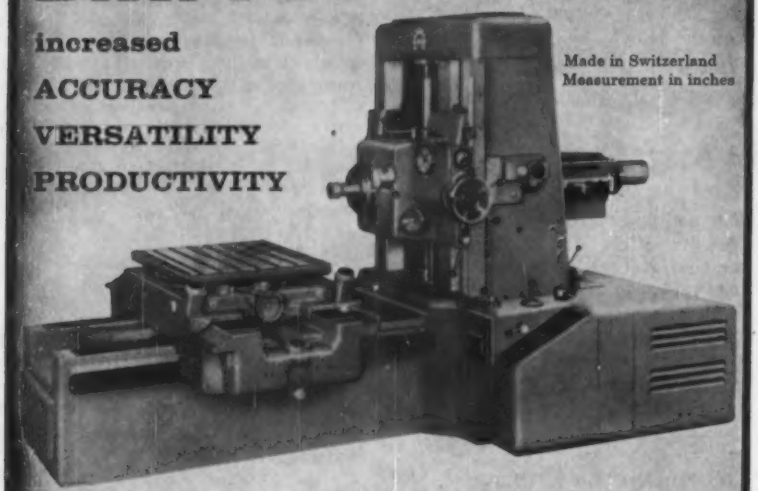
American Can Co, New York, has elected **Roy J Sund** president to succeed **William C Stolk** who has been named chairman and chief executive officer. Mr Sund has been vice president in the corporate executive department and general manager of the Marathon Division. He is succeeded in the latter post by **Donald A Snyder,** formerly assistant general manager at Marathon.

CUT ACCUMULATED ERRORS to a minimum

with the

DIXI 75 horizontal optical jig borer

increased
ACCURACY
VERSATILITY
PRODUCTIVITY



Made in Switzerland
Measurement in inches

- Automatic positioning can be changed instantly to manual operation
- Projected optical setting—direct reading to .00005" for linear motions and 1 sec. of arc for built-in rotary table. Linear optics provided with adjustable zero reference
- Simplified controls functionally arranged for greater operating speed and efficiency
- 3" diameter boring spindle
- Increased capacity: table size 39⅜" x 32"; 29⅝" cross travel; 23⅝" longitudinal travel; 25⅝" vertical travel
- Hydraulic feeds and infinitely variable spindle speeds
- Rear support optional

MBI has engineers available for consultation, guarantees service by factory trained staff, and stocks spare parts in New York.—Join the long list of leading aircraft and manufacturing plants throughout the United States which are using the horizontal optical jig borer.

Demonstrations upon request at our conveniently located demonstration centers.

MBI

M. B. I. EXPORT & IMPORT LTD.
A DIVISION OF MACHINERY BUILDERS, INC.
475 Grand Concourse, Bronx 51, N. Y.
Swiss Accuracy plus U. S. Know-how

NAMES IN THE NEWS...

Pratt & Whitney Co, West Hartford, Conn, has named **Paul N Stanton** vice president, marketing. He was formerly general sales manager of Clearing Machine Corp, Division of US Industries, Chicago

US Industries Inc, New York, has named **Hugh C Bream** president and general manager of Western Design, Goleta, Calif, division which designs and manufactures advanced electronic and electro-mechanical systems and components for aircraft and missiles. Previously manager of the division, he succeeds **C W Sponsel** who has resigned.

Canadian Clark Ltd, St Thomas, Ontario, has elected **Clarence E Killebrew** president to succeed **George Spatta**, named board chairman. Mr. Spatta is president of Clark Equipment Co, the parent firm in Buchanan, Mich. Mr Killebrew is a vice president of Clark Equipment and general manager of its Construction Machinery Division.

Black & Decker Manufacturing Co, Towson, Md, has named **Thomas J Bennett** general sales manager of **Master Power Corp**, Bedford, Ohio, subsidiary. **Edgar D McIntosh** succeeds Mr Bennett as central district manager, headquartered in Cleveland.

Oakite Products Inc, New York, has appointed **Daniel B Lamb** Detroit division manager. He replaces **Thomas R Smith** who is retiring after 19 years as head of the division.

Hurd Lock Manufacturing Co, Almont, Mich, division of Avis Industries Inc, has named **Carl Demrick** president. Mr Demrick was formerly president of the Amplex Division of Chrysler Corp.

Producto Machine Co, Bridgeport, Conn, has appointed **David E Glass** sales manager of the Machine Tool Division. Prior to joining Producto Mr Glass was New England sales manager of Consolidated American Machinery Co in Hartford

Ford Motor Co has named **Herbert L Misch** chief engineer of the product and production engineering office of the Metal Stamping Division. Formerly executive engineer, current car, in the Ford Division product engineering office, he replaces **H C Grebe**, appointed chief engineering consultant to the Metal Stamping Division

General Electric Co has appointed **William B Boyd** manager of manufacturing for the Specialty Transformer Department, Fort Wayne, Ind. He succeeds **J Richard Garvin** who has been named manufacturing manager for the Specialty Motor Department.

Kaiser Aluminum & Chemical Corp, Oakland, Calif, has appointed **Robert P Jensen** manager of industrial foil, laminations, and containers. **Robert H Lucas** succeeds Mr Jensen as industrial foil and container sales manager.

Macco Products Co, Chicago manufacturer of lubricants and cleaning compounds, has appointed **Arthur A Warford** to the newly created post of manager, customer service. Before joining Macco Mr Warford was chief chemist for Core-Lube Inc.

DI-ACRO ROD PARTER cuts off 3,250 pieces/hr. for Geometric Stamping Co.

Donald Boyd, methods engineer, shows parted stock and the formed part, handle for material handling equipment

About 1½ million pieces of bar stock are parted off each year on a Di-Acro Power Rod Parter at the Geometric Stamping Co. Div. of Euclid Stamping Co. in Cleveland. Twenty-foot lengths of 5/16″ cold drawn steel are cut to 7″ pieces at a rate of 3,250 pieces per hour.

"Instead of investing in a single purpose punch press die," says Donald Boyd, methods engineer, "We picked the power parter for its versatility. On this job and a variety of other work the power parter has increased production two times—it's actually twice as fast. Incidentally, there has been little or no maintenance other than periodic lubrication and resharpening of die heads."

For your bar stock up to ⅝″ in diameter, investigate the Di-Acro Rod Parter. Speedmatic gauge cuts as fast as operator can feed. Minimum distortion—pieces can be threaded without de-burring. One standard die cuts eleven sizes. Special square, hex and other heads.

DI-ACRO HAND OPERATED ROD PARTER

Same size-range and accurate parting as power parter. Ejectomatic gauge automatically clears die after each cut.

For free booklet, "Handy Guide to Rod Parters," consult yellow pages under Machinery—Machine Tools for your nearest Di-Acro distributor or write us.

Find Us Fast In The Yellow Pages

pronounced die-ack-ro

di-acro PRECISION METALWORKING MACHINES

O'NEIL-IRWIN MFG. CO.

405 Eighth Avenue • Lake City, Minnesota

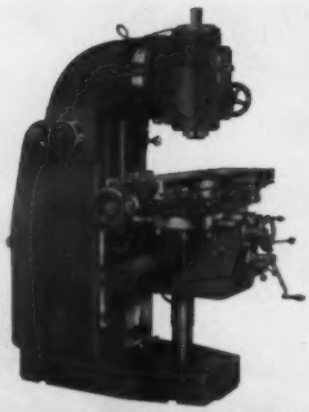
POWER PERSONIFIED

SAJO No. 2 Vertical Miller

Just a glance at this rugged machine confirms its ability to perform with ease the most demanding jobs. Sajo's swiveling head, power feed to quill and unrivaled spindle construction combine versatility with unsurpassed tool room accuracy.

Also available —
Horizontal Millers
Plain and Universal

No. 2 Vertical Miller
table size: 52" x 11"
7½ and 1½ HP motors
rapid power traverse



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Since 1865

FOR MORE PROFITABLE GRINDING

For toolroom or job shop this MSO Universal Grinder with 7" x 12" capacity is unexcelled in sensitivity, accuracy, finish.

MODEL FMES
a true Universal Grinder
with compound swivel
wheelhead
fine in-feed to .00005"

Whether for
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or production,
MSO offers
a complete line of
precision grinding machines
with features such as:

Automatic cycling
+ Precimatic sizing
+ Electronic Match Grinding

WRITE FOR LITERATURE ASK FOR REFERENCES

When only the best will do, check MSO first

austin industrial corporation

76-F Mamaroneck Avenue White Plains, New York

NAMES IN THE NEWS

Bendix Corp has appointed **Brian A Wilson** manager, western region, for the **Bendix Filter Division.** He will operate out of the West Coast regional office at Van Nuys, Calif.

Haloid Xerox Inc, Rochester, NY, producer of copying machines, has named **William C Allen** vice president in charge of machine manufacturing. He was formerly director of manufacturing for International Telephone & Telegraph Corp.

Kempsmith Machine Co, Milwaukee manufacturer of milling machines, has appointed **Harry Mussun** director of machine tool sales.

Cleveland Graphite Bronze Division of Clevite Corp has appointed **W D Cowgill** general sales manager. He was formerly Detroit district sales manager.

Snap-Tite Inc, Union City, Pa, producer of special purpose couplings, has appointed George A Clark general manager. He will continue to serve as treasurer.

Parker Rust Proof Co has named **Alexander Wilson** assistant manager of the western regional office in Chicago. He has been associated with the firm since 1953.

P R Mallory Co has named **J R Roberts Jr** president of **Indar Corp,** Indianapolis subsidiary which specializes in manufacture of powder metal parts. Mr Roberts was manufacturing superintendent and chief industrial engineer for Mallory Metallurgical Co prior to his move to Indar.

Arguto Oilless Bearing Co, Philadelphia producer of oil-impregnated plastic alloy bearing material, has named **James F Nicholas** chief engineer to head the new product development program. Mr Nicholas has been associated with Philco Corp, Keasby & Mattison Co, and for the past several years has been an engineering consultant.

OBITUARY

Walter H Geier, a former director of the Cincinnati Milling Machine Co, died June 16 at his home in Cincinnati. Mr Geier was the last of four brothers who were active in the development of the firm. Their nephew, Frederick V Geier, is now chairman of the board.

Want low-cost parts finishing?

NOW—CHOOSE FROM 7 NEW ALMCO VIBRASHEEN MACHINES

TO DO YOUR

- DEBURRING
- DESCALING
- BURNISHING
- SURFACE REFINEMENT
- CLEANING

10 to 100 Times FASTER!

7 SIZES FOR EVERY JOB REQUIREMENT

Model	Tub Capacity	Tub Size, Inside		
		Length	Width	Height
VT-70	¾ gallon	7"	4¾"	6"
VT-71	1 cu. ft.	12"	12"	12"
VT-72	2½ cu. ft.	15"	16"	18½"
VT-75	5 cu. ft.	31"	17"	19½"
VT-77	7 cu. ft.	31"	17"	22½"
VT-712	12 cu. ft.	35"	25"	30⅜"
VT-717	17 cu. ft.	47"	25"	30⅜"

New VT-72 Vibrasheen being unloaded into optional hoist-pan. Note convenient height of controls.

ANOTHER REPORT FROM THE ALMCO ALBUM OF NEW PRODUCTS

IT'S A FACT! With the seven (7) new ALMCO Vibratory Machines, you can expect finishing time cycles 10 to 100 times faster than with standard horizontal barrel finishing equipment. It's a significant production break-through, made possible by creating constant vibratory motion to activate the entire mass of media and parts in the finishing container, as compared to only 20% activation with conventional barrel finishing methods.

The uniform vibratory motion of the media in recessed areas, blind holes and small I.D. dimensions make it possible to obtain optimum results on a multitude of applicable parts with intricate configurations that can not be completely processed in standard horizontal barrel machines.

What's more, this amazing metal finishing machine only requires 50% of the floor space that is taken up by any other machine of this type with a similar capacity. Time and motion is at the absolute minimum with all convenient operating conditions.

Tub features. Holds a 2½ cu. ft. load of parts and media. Equipped with vibrating mechanism adjustable for impact range of from 600 to 2550 lbs.; has a vibration frequency of 3380 rpm with variable drive optional. Pivots through 180° arc. Lined with tough ⅜" plastisol. Quick-acting cam-lock drain door facilitates flushing of tub.

Investigate today, the ALMCO *Vibra-Sheen way!*

FREE

NEWS ABOUT ALMCO'S NEW PRODUCTS

New Almco Album describes the latest in metal finishing machines, methods and media. Write today for free copy!

ALMCO

Queen Products Division • King-Seeley Corporation

57 E. Main St. • Albert Lea, Minnesota

SALES AND ENGINEERING OFFICES: Chicago, Detroit, Los Angeles, Newark, New Haven, and Philadelphia

IN ENGLAND: Almco Division of Great Britain, Ltd., Bury Mead Works, Hitchins, Herts, England

JOHNSON MODEL J . . . A big, rugged saw that cuts anything—anywhere! 10 rounds, 18" flats, heavy structurals and odd shapes. Available in wet or dry cutting models, variable speed drive and optional equipment

JOHNSON MODEL B . . . Also available in wet or dry, metal cutting models, variable speed drive. Will easily handle 5" rounds, 10" flats, odd and irregular shapes

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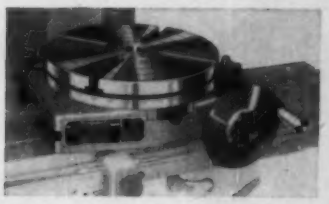

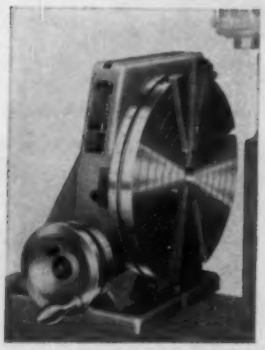

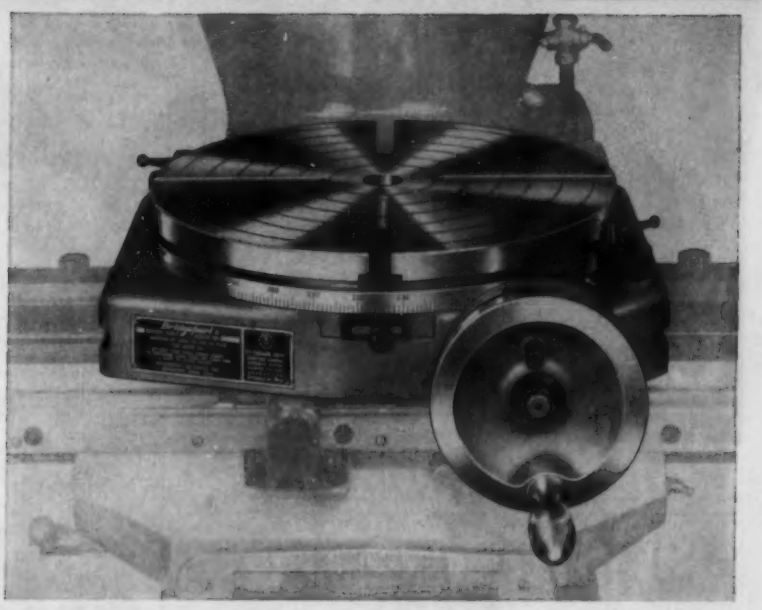

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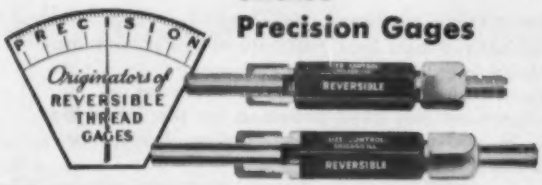

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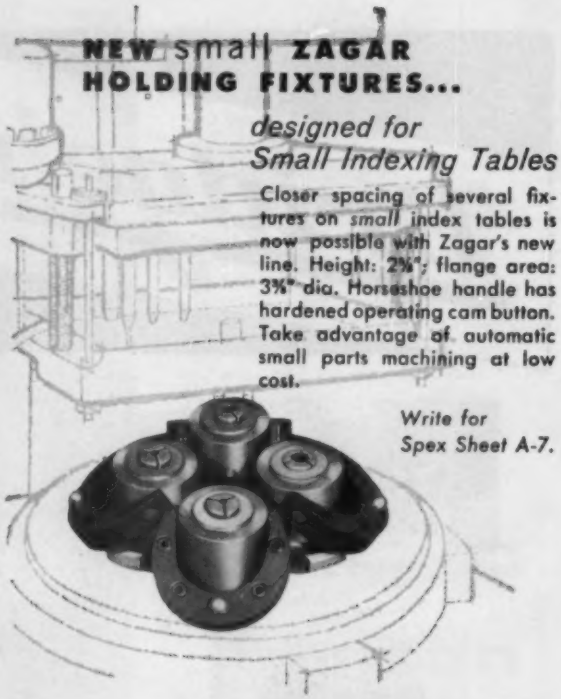

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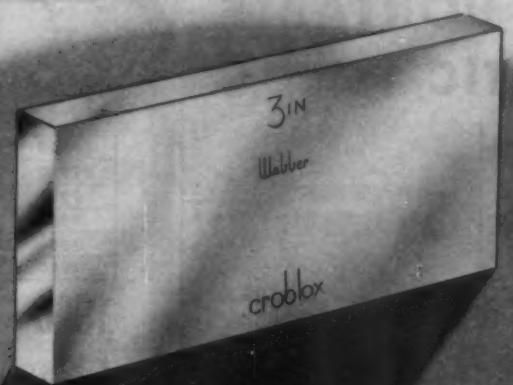

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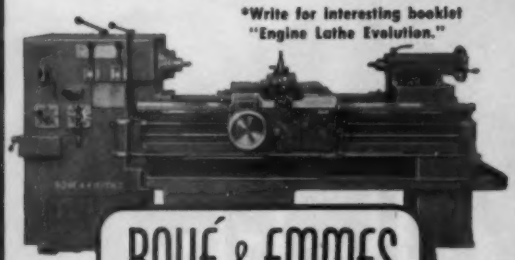

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ADVERTISERS' INDEX AND BUYERS' REFERENCE

Listed below are used, surplus new and rebuilt machine tools or services as advertised in this section.

The numbers after the advertiser's name, indicates the products or services offered by the advertiser.

1. Accessories
2. Automatics
4. Bending Machines
6. Boring Mills
7. Broaching Machines
9. Centering Machines
13. Cutting Off Machines
16. Drilling & Reaming Machines
17. Electric Motors
18. Engraving Machines
24. Gear Cutting Machines
25. Grinding Machines
27. Honing & Lapping Machines
30. Lathes
36. Milling Machines
40. Planers
43. Press Brakes
44. Presses
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53. Shapers
54. Shears
60. Threading & Tapping Machines
63. Welding Equipment

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National Machinery Exchange	213	30, 44
Radax Manufacturing Co.	215	2
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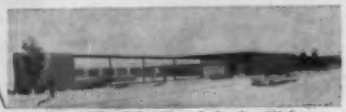

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36"x30' co (Maxmn 30'8") Niles "Time Saver", m.d.
36"x100" centers LeBlond, m.d., late
36"x144" co Wicken Quick Change 3 step cone pulley belt drive
38" raised in the sand to swing 48" over bed (40" over Bridge) x 112" Lehmann Hydrotel, m.d.
38"x21' 5½" centers Lodge & Shipley Selective, m.d.
48"x41' co Niles Internal Geared H.D., m.d.

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22" x 24' centers Monarch Model CM Geared Head Lathe, actual swing 27½", 16 speeds, two Carriages, tapers.

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10' ¼" Webb Roll, 1946
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*#33 Excello Thread, 5 way dresser, RBG
*100 Bryant Int. Now Spdl. (1947) RBG.
**10x24 #4861 Van Norman Ext. 20 HP (1955)
**30 x 48 Landis CHW Ext Like New
*2 Cine. Centerless, Hydr Profile Dresser RBG

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*30 x 36 x 120" Thompson Horiz. Hydr. (1948)

JIG BORER

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**20 x 72 Monarch Tracer, Thrdg., etc.
*30 x 96 Niles "Timesaver" T.A. SJ, 4J RBG
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**30" DoAll H.S. Vert. Bandsaw, Hydr. Tbl (1955)

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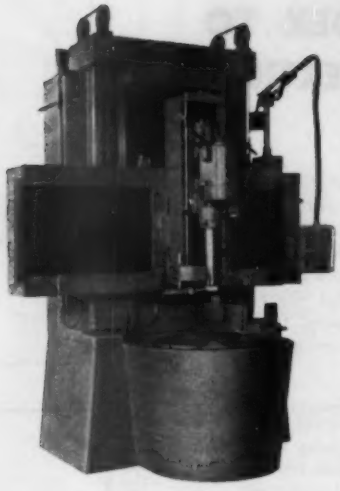

model 3-TR
52" swing

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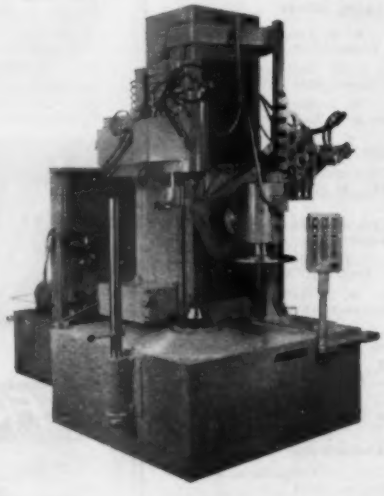
If you would like to know more about Springfield vertical grinders, please write for Bulletin 197-G.

MMT-PE

new developments coming!



vertical contour grinder

SPRINGFIELD

The Springfield Machine Tool Company
Springfield, Ohio

more metalworking facts free from

American Machinist | ***Metalworking Manufacturing***

These handy, prepaid cards will bring you more data on:

- **PRODUCTS ADVERTISED**
- **NEW EQUIPMENT DESCRIBED**

also

- **COPIES OF CATALOGS OFFERED**

now

EVERY ADVERTISEMENT,*
NEW EQUIPMENT ITEM,
AND CATALOG OFFERED
IN THIS ISSUE IS NUMBERED

* *A few advertisements cannot be keyed and must be indicated by writing the Advertiser's name at the bottom of the card.*

• *for full details on how to use these cards, see reverse side . . .*

First Class Permit No. 64 (Sec. 34.9 P.L.&R.) New York, N. Y.

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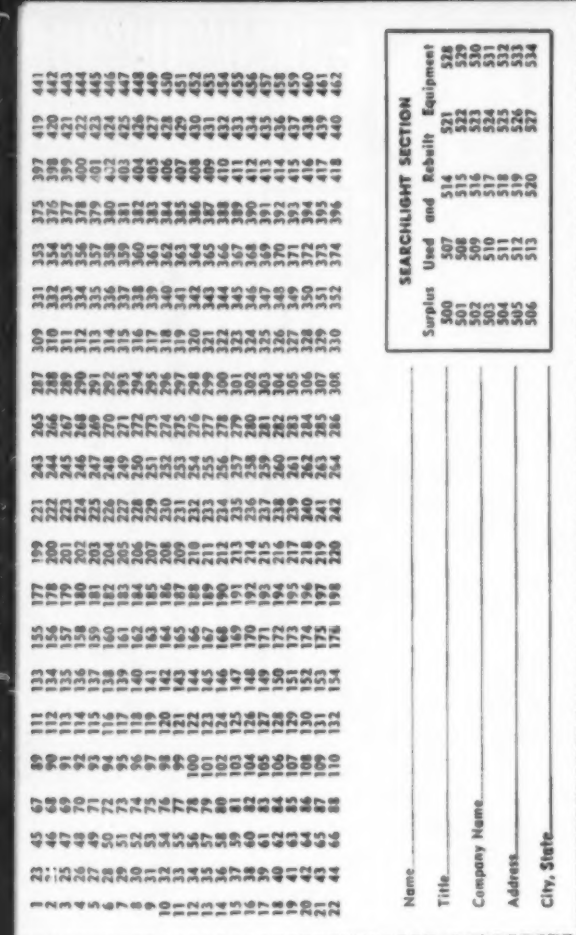


SEARCHLIGHT SECTION

Surplus	Used and Rebuilt	Equipment
500	507	514	521	528
501	508	515	522	529
502	509	516	523	530
503	510	517	524	531
504	511	518	525	532
505	512	519	526	533
506	513	520	527	534

Name_____

Title_____

Company Name_____

Address_____

City, State_____

SEARCHLIGHT SECTION

Surplus	Used and Rebuilt	Equipment
500	507	514	521	528
501	508	515	522	529
502	509	516	523	530
503	510	517	524	531
504	511	518	525	532
505	512	519	526	533
506	513	520	527	534

Name_____

Title_____

Company Name_____

Address_____

City, State_____

more data?

it's easy

1. Circle Key Number(s)
on these cards that
correspond(s) to number(s)
at bottom of advertisement(s),
new equipment item(s)
or catalog(s) offered

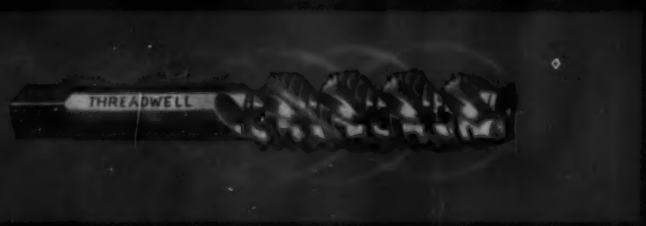
2. Print clearly . . .
name, title, company name and address

3. Tear Off and Mail . . .
We'll do the rest

Use these time-saving cards to keep up-to-date with the metalworking industry

CIRCLE 152 READER SERVICE CARD ▶

Only TURBO-CUT by Threadwell has a full 3-4 thread plug chamfer!



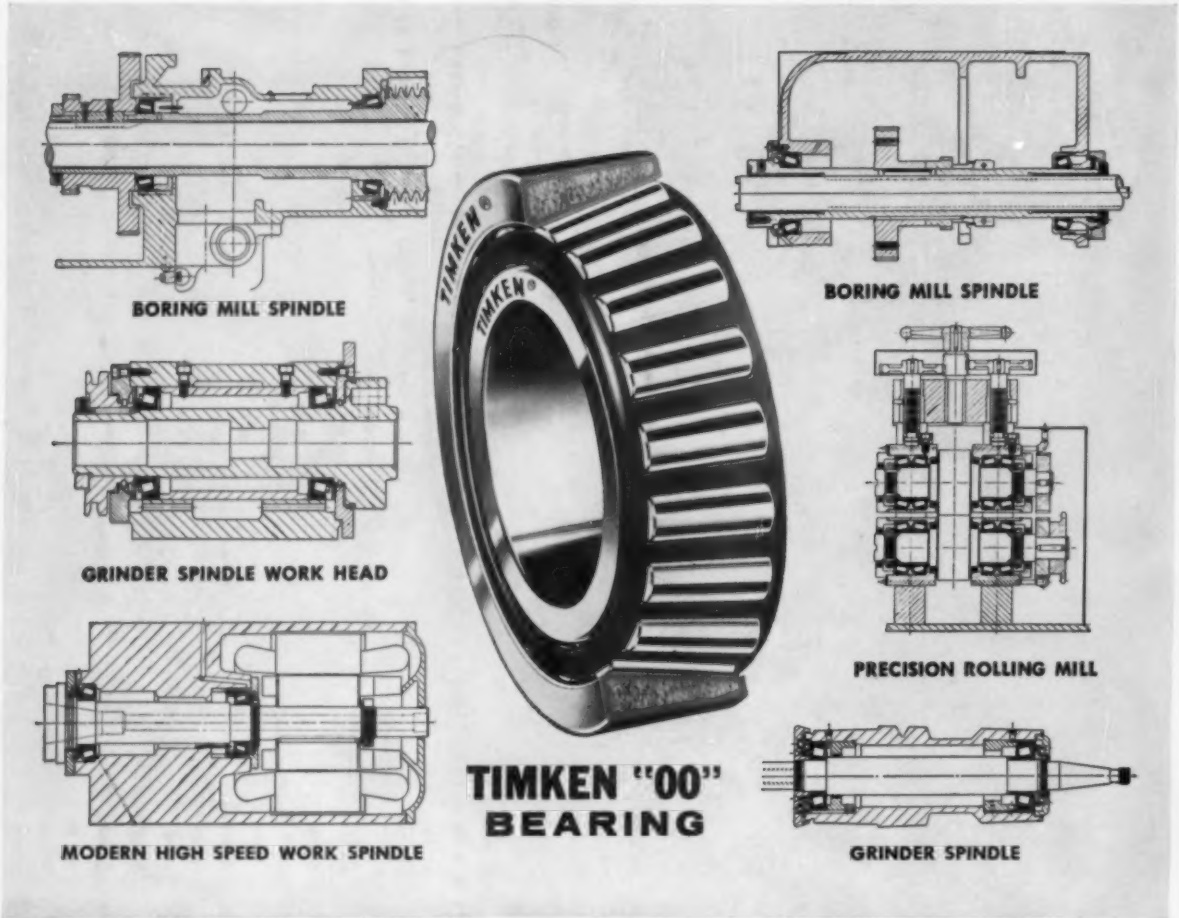
Benefit? Turbo-Cut's longer chamfer distributes the load over more teeth and breaks up chips to minimize tap breakage. Turbo-Cut's longer chamfer makes tapping easier and cleaner on through holes, does a one-pass job on blind holes. Only Threadwell makes the genuine Turbo-Cut with the longer chamfer.
Also available in bottoming chamfer.

Threadwell
MAKES THE BEST PRODUCT BETTER

INDUSTRIAL DISTRIBUTORS THE RIGHT HAND OF INDUSTRY

THREADWELL TAP & DIE CO.
GREENFIELD, MASSACHUSETTS

Stocking Warehouses: New York — Cleveland
Detroit — Los Angeles — Greenfield, Mass.



When you need super precision, use this—the world's most accurate tapered roller bearing

IF you're looking for greater accuracy on machine tool spindles or other bearing applications, you can get it with Timken® "OO" tapered roller bearings. Maximum allowable run-out is only 75 millionths of an inch (.000075″), the closest tolerance in any tapered roller bearing in regular production.

Developed to meet industry's ever-increasing needs for greater precision, "OO" bearings are made in a special plant, as are two other high-precision bearings: "O" with maximum allowable run-out of .00015″ and #3 with maximum allowable run-out of .0003″. The accuracy of all these bearings is guarded by our modern gage laboratory—one of industry's finest.

The "OO" is another example of Timken Company leadership in tapered roller bearing design and manufacture. The experience gained in developing it assures greater precision, longer, better performance in *all* the Timken bearings you buy. And they are made from the finest bearing-quality alloy steel available.

To get super precision that will give your products the ultimate in accuracy and surface finish, specify Timken "OO" bearings for the machines you build or buy. ***When you buy Timken bearings you get...*** *1) Quality you can take for granted. 2) Service you can't get anywhere else. 3) The best-known name in bearings. 4) The pace setter in lower bearing costs.* The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits. Canadian Division: Canadian Timken, St. Thomas, Ontario.

Industry rolls on

TIMKEN®

tapered roller bearings

CIRCLE 153 READER SERVICE CARD